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Proceedings of the Section of Apiculture of the American Association of Economic Entomologists

The Section of Apiculture of the American Association of Economic Entomologists convened in the Central High School, Washington, D. C., at 9:30 A. M., Mr. R. W. Harned, Chairman of the Section, presiding.

CHAIRMAN HARNED: The first paper on the program will be the report in regard to the Seventh International Apicultural Congress by Dr. Phillips.

THE SEVENTH INTERNATIONAL APICULTURAL CONGRESS

By E. F. PHILLIPS, *New York State College of Agriculture*

ABSTRACT

A brief account is given of the Seventh International Apicultural Congress, held in Quebec, Canada, September 1 to 4, 1924, at which the author acted as delegate for the Association of Economic Entomologists.

The Seventh International Apicultural Congress was held in Quebec, Canada, September 1 to 4, 1924. Prof. F. Eric Millen, Ontario Agricultural College, Guelph, Ontario, and the writer represented the Association of Economic Entomologists at this Congress, and Messrs. James I. Hambleton, Bureau of Entomology, Washington, D. C. and R. B. Willson, New York State College of Agriculture, Ithaca, New York, were alternate delegates. All four persons were present at the Congress.

At the Sixth International Apicultural Congress, held in Marseilles, France, September, 1920, an urgent plea that the next Congress be held in Quebec was made by M. Cyrille Vaillancourt of the Quebec Department of Agriculture, and this request was finally granted after long discussion. Great credit should be given M. Vaillancourt for his efforts to get the Congress sufficiently near so that a large number of American beekeepers might attend and thus get in touch with their fellow workers of Europe who for a number of years have maintained these Congresses

without American aid. Still greater credit must be given M. Vaillancourt for his indefatigable efforts in making the entire Congress a wonderful success.

The Congress opened on September 1 in the Knights of Columbus Hall, Quebec, under the temporary presidency of M. Vaillancourt. He was promptly made permanent president of the Congress and presided over the French-speaking section, while Mr. C. B. Gooderham, Central Experiment Farms, Ottawa, was made general chairman of the English-speaking section. The joint meeting of the two sections was then addressed by various officials of the Quebec government and by the several delegates, after which the plans for the several conferences were announced. A different chairman was appointed for each session of each section, and different persons were similarly delegated to act as secretaries of the sectional sessions and to read papers prepared by persons who could not be present. In this way the burden and honor of officiating at the sessions were divided. The chairman of the English-speaking section in the order in which they presided, were E. F. Phillips, G. T. Newton, F. Eric Millen and George S. Demuth, both delegates of the association being thus honored. The two alternate delegates of the association served as secretaries of sectional meetings. The chairmen of the French-speaking section were MM. C. P. Dadant, Ph. J. Baldensperger, A. Mayor and L. Tombu, the last three beingEuropean delegates, the first being the well-known editor of the *American Bee Journal* who was equally at home in both sections.

Following the joint opening meeting, the sections were conducted separately, the English-speaking section meeting in the Parliament Building. The subjects discussed were: Selection and Artificial Breeding of Queens according to Modern Methods, International Connections to be Maintained between Countries to Promote the Sale and Marketing of Bee Products and By-Products, Swarm Control, Better Methods for Combating Bee Diseases, and Organizing Associations and Development of Propaganda for Increasing the Sale and Consumption of Honey. Papers submitted to the Congress had all been translated so as to be available for both sections. So many papers had been submitted that it was wholly impossible to read them all, and the papers presented were chiefly those prepared by those in attendance. In a few cases it was possible to read papers from those not present and in some cases to give brief abstracts of the papers submitted. The proceedings of the Congress are now being prepared for publication, and all papers submitted and accepted by the Congress will be published in both French and

English, whether or not they were read at the sessions. This entails a vast amount of work for M. Vaillancourt and his able assistants, but when published these proceedings will constitute a valuable addition to beekeeping literature. The proceedings will also be made available to those who were not members of the Congress at the price charged for active membership, namely $2.00 per copy.

French beekeepers were especially helpful in submitting papers for the Congress and the subject of queen-rearing which has recently attracted so much attention in France was given special attention by these writers. The subject of international relations was discussed only by Mr. C. P. Dadant, who favored free trade, not only in honey and bees but in all commodities. Swarm control was discussed by several writers, but the chief paper was by Mr. George S. Demuth who has given us the cause of swarming, and his paper at the Congress attracted much favorable comment. At the English-speaking section the discussion of bee diseases was shortened by abstracting the various papers submitted, after which the writer was asked to discuss the recent work in the control of the two serious brood diseases. The advancement of sales of honey was discussed at great length at the French section, papers being read by a number of persons interested in Home Economics. In connection with the discussion of queen-rearing methods, a demonstration was given by two Canadian queen breeders which attracted much attention, especially among the foreign delegates who were less familiar with American queen-rearing methods.

Delegates from European countries were not numerous, doubtless because of the distance and the expense, and especially because of the money depreciation existing in most European countries. Those who came were, however, among the leading beekeepers of Europe. They were M. Ph. J. Baldensperger, Nice, France, who represented all the French beekeeping societies and whose work on races of bees is known to beekeepers throughout the world, M. A. Mayor, who represented the Swiss beekeepers, M. Léon Tombu, Brussels, Belgium, permanent secretary of the International Apicultural Congresses who represented Belgium, and two delegates from Italy. Peru was represented by an official from the Peruvian consulate in Quebec who is not a beekeeper. Most of those present were either official delegates or visitors from the United States and Canada. A considerable number of state associations from the United States were represented officially, and delegates and visitors were present from several Canadian provinces. Naturally the Province of Quebec was best represented and these persons generally

attended the French-speaking section. There were, however, many occasions on which the attendants at the two sections were able to mingle and get acquainted.

The last session, held on the morning of September 4, was again a joint session and the disease discussion of the French-speaking section was held over until that time to give opportunity for remarks by some who had attended the English-speaking section for the discussion of that topic. Following that discussion, it was voted to leave the time and place of the next Congress to a committee. Two important resolutions were then passed by the Congress, and there was no opposition to these resolutions which call for international safeguards to prevent the introduction to new countries of diseases now known to be limited in their distribution. The Congress then closed with a happily worded address by the President of the Congress, M. Vaillancourt. The next Congress will probably be held in Europe, since these Congresses have been chiefly European and the beekeepers who have worked for them are entitled to the privilege of attending them. It is hoped, however, now that American beekeepers have become more familiar with the work of these important Congresses, that they will continue to take an interest in them and perhaps before many years we may again have the privilege of having another Congress on this continent.

This scant outline of the program and proceedings fails utterly to give an adequate impression of the Congress. To meet the distinguished beekeepers from European countries, especially M. Baldensperger, was a treat to those of us from this side of the ocean. To meet again old acquaintances and to meet new beekeepers from this continent for a discussion of the important topics announced was well worth the trip to Quebec. The foreign atmosphere of the ancient but still modern city of Quebec added much to the pleasure of the Congress for the American delegates and visitors, and altogether the occasion was a most happy one. Nothing marred the pleasure of the visitors throughout their stay and we may all look back with unmixed pleasure on this Congress.

Throughout the Congress the delegates were in a sense the personal guests of the beekeepers of Quebec and they left no stone unturned to add to our pleasure. On the evening of September 2 all visiting delegates were the guests of the beekeepers of the Province at a French-Canadian dinner served at Ste. Ann de Beauprè, which proved one of the most interesting events of the Congress. The delegates were taken to Ste. Ann by automobile, a ride which will long be remembered for its speed. Other pleasant events were constantly planned and the delegates were

kept so busy that they scarcely had time to see the sights of the old city. For all this entertainment, we were indebted to the beekeepers of the Province, and special mention must again be made of the labors of M. Vaillancourt who planned and carried out most of these events.

In connection with the Congress a wonderful exhibition of honey and bee products was arranged at the Canadian Exposition held in Quebec the same week. The exhibit included a large variety of honeys and many products made with honey, many of which had been imported from Europe in order that beekeepers on this side might become familiar with them. The most striking feature of the exhibit was an elaborate Eiffel Tower built of honey which occupied the center of the building in which the honey was placed. Honey had been donated by several hundred Quebec beekeepers for this purpose and the entire exhibit was doubtless the finest honey show ever made on the continent. In honor of the holding of the Congress at the time of the Exhibition, it was designated "The Year of the Bee" by the officers of the Exhibition.

The entire Congress was a success and was so voted by all present. It is gratifying that the Association of Economic Entomologists was officially represented and the writer desires to express his appreciation of the honor of acting as one of the delegates for this organization.

CHAIRMAN HARNED: Is there any discussion of the paper?

Secretary Bentley took the chair and the chairman presented the following paper illustrated by lantern slides.

FOUL BROOD DISEASES IN MISSISSIPPI

By R. W. HARNED, *Agricultural College, Miss.*

(Paper not received in time for publication in this issue.)

CHAIRMAN HARNED: The second paper on the program will be given by Dr. Garman.

NOTES ON BEE DISEASES IN CONNECTICUT

By PHILIP GARMAN, *New Haven, Conn.*

While engaged in testing the efficiency of alcohol-formalin solutions in control of American foul brood, I obtained from one of our beekeepers a hive supposedly infected with American foul brood. Fully half the brood in these combs was diseased, the dead larvae and scales numerous, sunken and punctured caps present, as you will see in the slides, and the whole having the odor of a glue factory or worse. Some of the larvae in

which the disease was well advanced had a rubbery consistency and in fact the gross characters were so much like those of American foul brood that I decided to use the hive for testing the solution, in spite of the fact that microscopical examinations were negative. Some of these combs were shown to others well versed in bee culture who likewise pronounced it American foul brood. Shortly after treatment, however, the trouble reappeared in the combs, but this time had the characteristics of sacbrood and not so much that of American foul brood. It remained with the colony throughout the summer but did little damage. Examinations of the hives in the yard where the original combs were obtained later in the summer showed only sacbrood (but still abundant) and specimens sent to Washington by our inspector, Mr. Coley, were identified as this disease.

The owner of these colonies tells me that the disease which he claims has been present for ten years, has done considerable damage, and I think you will agree with me that a hive in this condition is not worth a great deal. Our inspector for this region reports many colonies in this particular vicinity to be in a similar condition, and I wonder if we have not underestimated the seriousness of the disease. Certainly, such bees cannot produce much honey and as far as being a self-curative disease, at least in Connecticut, this does not always apply. The alcohol-formalin treatment did not clear it up entirely. Shaking apparently did no good. We have advised requeening, but I am not sure that this is the best method of handling the trouble. It presents a puzzling situation which perhaps some of you can clear up.

In 1924, our inspectors examined 8929 colonies of bees and found 47 with European foul brood, 47 with sacbrood and 20 with American foul brood. There was in 1924 therefore as much sacbrood in the State as European foul brood and about twice as much sacbrood as American foul brood. This condition is not always found by the inspectors, but a greater or less amount of sacbrood is always found. It would seem from the general state of affairs that some treatment should be necessary, and it may be that requeening is the proper procedure, but of this, there is considerable doubt.

To summarize then:—it may be stated that there is in Connecticut a virulent strain of sacbrood which is doing considerable damage; that its gross characteristics are strikingly similar to American foul brood and easily confused, and that it does not always disappear spontaneously; that sacbrood is a more serious disease than we realize and better means of control should be devised.

CHAIRMAN HARNED: Is there any discussion of this paper?

MR. A. P. STURTEVANT: May I ask if any microscopical examination was made of the scales you described for bacteria?

DR. GARMAN: I looked over the forms pretty carefully in making examinations of scales here and there in the frames similar to that one I showed on the screen, and I couldn't see any signs of bacteria. I didn't make any cultures from them.

CHAIRMAN HARNED: The next paper is by Mr. A. P. Sturtevant, of the Bureau of Entomology.

PHYSIOLOGICAL FACTORS AFFECTING THE DEVELOPMENT OF THE BROOD DISEASES OF BEES

By A. P. STURTEVANT, *U. S. Bureau Entomology*

(Withdrawn for publication elsewhere.)

CHAIRMAN HARNED: Is there any discussion?

It is customary at the beginning of the session to name some committees and as I failed to do so then I will do that now.

On the Nominating Committee I will ask the following members to serve: Dr. Phillips, Dr. Newell and Dr. Britton.

On the Resolutions Committee I will ask the following to serve: Dr. Fracker, Mr. Hamilton and Mr. Goodwin.

The next item is a paper by Mr. J. I. Hambleton.

THE QUANTITATIVE AND QUALITATIVE EFFECT OF WEATHER UPON COLONY WEIGHT CHANGES

By J. I. HAMBLETON, *U. S. Bureau of Entomology*

ABSTRACT

Correlations were made during the spring honey flows of 1922 and 1923 at Somerset, Maryland, between changes in weight of a colony of bees and daily variation in temperature, relative humidity, hours of sunshine and solar radiation. By use of the formula for multiple correlation, exact response to changes in weight of the colony to changes in each of these weather factors was calculated. A variation in colony weight depends upon two factors acting jointly, namely the nectar secretion activity on the plants and the behavior of bees engaged in gathering nectar and pollen.

From the above mentioned calculations the exact weight was given to each of the weather factors considered. A variation from the average temperature was thus noted to have either a positive or a negative effect upon the weight of the colony which in turn could be expressed in terms of grams depending upon the number of degrees the temperature varied from the average. For example, when the daily

temperature was four degrees above the average, there resulted from this an increase in colony weight of so many grams due to this one factor alone. Although the other weather factors were constantly affecting the weight of the colony, at the same time the results attributed to temperature, for instance, represent that factor alone since corrections were made in each case for the effect of other factors. A quantitative as well as a qualitative analysis is given for all the weather factors enumerated above.

(Withdrawn for publication elsewhere.)

CHAIRMAN HARNED: Is there any discussion of Mr. Hambleton's paper? If not, the Secretary of the American Association of Economic Entomologists has some announcements to make.

. . . Secretary Collins made several announcements at this point. . . .

CHAIRMAN HARNED: The next paper is by Mr. W. A. Price.

THE SENSE OF SMELL AGAIN

By W. A. PRICE, *Lafayette, Ind.*

It is pretty generally understood that the sense of smell plays a large part in the activities of the bee and especially that phase having to do with the location of nectar, nectar secreting plants and other materials used as food. However an incident coming under my observation, and one which I shall here relate, causes me to attach more importance to this phase of the bee's activity than I had heretofore done.

On Saturday, October 4, 1924, I prepared some sugar syrup for winter stores. The cooking was done in an open double boiler in a basement room of the Agricultural Building at Purdue University. This room is surrounded on all sides except one (north) by other rooms. There are four windows on the north or exposed side situated high on the wall and provided with ventilators. The window nearest the boiler was raised at the bottom about three inches and all others were closed at the time the cooking operation was started. The water was raised to the boiling point before the sugar was added. This was done at 10:45 A. M. Within 15 minutes of the time the sugar was put in the boiler, bees began bombarding the windows. My attention was directed to the window (as I was only five feet from it) and I immediately closed it to prevent any of the bees getting into the room. At this time (11:00) there were 14 bees trying to get into the room through the window. This interested me because no bees had obtained entrance and therefore it is not likely that any of the first arrivals returned to the hive with the much talked of dance to inform the sisters of the new field of stores. However since I did not observe the first arrival I could not be positive that all of the

fourteen arrived at about the same time. I allowed the syrup to cook one and one-half hours and during this period tried to keep a record of the number of bees coming to the windows. Thirty minutes after the cooking operation started I estimated (as it was impossible to count accurately) there were 90 bees trying to gain entrance to the syrup room. At 11:35 or 45 minutes after cooking started there were about 110 bees at the window and 15 minutes later there appeared to be about the same number. 15 minutes later or at 12:00 there seemed to be a slight decrease in numbers—there appeared to be about 90 and at 12:30 when the cooking operation was stopped there were only about 50 bees at the window. The can of syrup (80 pounds) was taken immediately from the boiler and placed in a cooling room formerly used as a refrigerating room and surrounded on all sides by other rooms. Thirty minutes after removing the syrup from the cooling room the bees had completely deserted the windows that they had so strongly bombarded earlier in the day.

Not being exactly satisfied with these observations, I repeated the experiment on the following Monday, Oct. 6th, and on Wednesday, Oct. 9th. The same syrup was brought into the cooking room on October 6 and heated to boiling. At this time I was on the look out for the first bee to appear at the window. The cooking was started at 10:15. The syrup was steaming at 11:00. There was a rather brisk wind and this coupled with the slow heating of the syrup may have made the lure less effective. At any rate the first bee came at 11:40 and during the period of 1 hour (11:40–12:40) 16 bees tried to gain entrance at the window.

On October 8 under mild bright weather conditions the experiment was repeated. This time however new syrup was made raising the water to the boiling point before adding the sugar which was done at 11:35. Also the window was opened and the bees were killed as they entered. A time record of entry was made as follows:

Time	No. Bees
11:45	1
11:50	1
11:55	1
11:57	1
11:58	1
12:00	2
12:01	1
12:04	1
12:05	2
12:06	1
12:07	1
12:10	1
12:12	1

Time	No. Bees
12:13	2
12:14	1
12:15	1

It will be noticed that the first bee arrived 10 minutes after the sugar was added to the boiling water and altogether 19 bees came during the thirty minute period from 11:45 to 12:15.

There was no information carried back to the hive by the bees that entered the room and I am inclined to believe that they were lured individually by the odor emanating from the room.

CHAIRMAN HARNED: The next paper is by Mr. Fracker.

FEDERAL COOPERATION IN APIARY INSPECTION PROPOSED

By S. B. FRACKER, *Madison, Wisc.*

ABSTRACT

Joint federal and state participation in a campaign to eradicate or control the bee disease, known as American foulbrood in apiaries is proposed by the American Honey Producers League. The project has already been approved by several state beekeepers' associations. The area clean-up plan is suggested as the method of procedure, as it is proving successful in a number of states. A favorable recent development is the discovery of an efficient disinfectant for diseased combs.

Recognition of the importance of beekeeping in American agriculture, and of the increasing seriousness of the American foulbrood situation, are involved in the proposed federal bee disease eradication and control campaign. Adoption of this program by Congress and the United States Department of Agriculture will mean entrance on a long-time attempt to bring under control one of the most contagious and fatal diseases of any domesticated animal.

The success of federal eradication and control programs in recent years has become so marked that those interested in beekeeping naturally look for help from this source. Joint state and federal participation in such campaigns as the eradication of the cattle fever tick, foot and mouth disease, citrus canker, and the pink-bollworm, have shown the possibilities. State support and sympathy are essential in all such cases to provide the necessary legal authority and enlist public sentiment, while the greater resources of the federal department assure adequate finances and guarantee an efficient, consistent and uniform policy.

One of the objects of the American Honey Producers' League since its organization has been an improvement in the bee disease situation in this country. At several conventions the matter has been discussed, but

all plans formulated prior to one year ago have been of a negative rather than a positive nature. That is, they have proposed retarding the further interstate distribution of bee diseases, leaving their elimination to the individual states.

A sentiment in favor of more active federal participation in such work has developed during the past two years. In January 1924, a definite eradication and control program under joint state and federal administration was proposed by representatives from the states of Michigan, Wisconsin, and Ohio, acting independently. The response was favorable and a League committee has since been working on the project.

It is suggested that the work be undertaken on the area clean-up plan, without attempting to spread federal funds over the entire country at one time. About a dozen states are already following this policy within their own borders, at least two of which (Mississippi and Florida) are endeavoring to keep the entire state completely free of American foulbrood infection. The others are working in certain counties or areas and attempting to secure freedom from disease there. In Wisconsin, Wyoming, and Ohio, the work is largely in the more heavily infected sections of the states concerned, while in Michigan the plan of first eliminating the traces of disease in the thinly settled counties is being followed.

Sufficient progress has now been made to show the efficiency of this general method and to recommend its adoption as a national policy. When the infection percentage is low it is proving comparatively simple to eradicate the disease completely, although (a) a complete survey of all the apiaries in the area, and (b) an adequate and thorough follow-up system are essential. Reports from Florida, Mississippi, and upper Michigan point toward the apparent complete eradication of American foulbrood from those areas.

The inspectors of Wisconsin are finding that infection is reduced at the rate of about 50% a year in heavily infected areas and that the number of apiaries with diseased colonies can be brought down from thirty or forty to two or three per cent with relative rapidity. As with human contagious diseases, such as smallpox and diphtheria, the last trace is harder to locate and dispose of, but even that difficulty is not insurmountable.

It is proposed to ask for a federal appropriation of considerable size, part of which might perhaps be made conditional on state participation. Some of it should be available for research on methods of disinfection

and disease eradication, but most should be employed directly in field activities.

The choice of federal control areas would have to rest with the Washington administrative office, but the factors of (a) maximum value to the industry, (b) adequacy of state legislation and organization, and (c) probable permanent maintenance of the area in a healthy condition after eradication, would require consideration in determining them.

Apparently the only substantive power needed by the federal office under this arrangement would be authority to provide against the interstate importation of infected material into clean-up areas. So many varying factors enter into this problem that authority should be given the department to make regulations for this purpose. The details of such provisions cannot well be included in general legislation.

A new development of the greatest value in this connection is the discovery of the efficiency of Hutzelman's alcohol-formaldehyde solution for the disinfection of combs. As shown by Dr. Phillips, and also by the writer, the greatest obstacle to successful clean-up work is the large commercial apiary. Destruction of all the combs on the premises of every large apiary in which a single infected colony is found, would be not only wasteful and unjust but probably entirely illegal. And yet, old extracting combs are the most persistent sources of disease known. Finding a method of economically treating all such combs in a yard with even a trace of infection, has removed the greatest obstacle to the prosecution of a successful control program. Wisconsin, Wyoming and other states are already engaged in carrying on such treatments on a community basis, and while more research is necessary to reduce the cost, this method is believed to be an unqualified success.

Whether adequate financial support can be secured depends on the beekeepers themselves, especially the members of state and national organizations. If they are active in its support, that result can be accomplished.

CHAIRMAN HARNED: Is there any discussion?

MR. E. N. CORY: Mr. Chairman, this very excellent presentation of the subject by Dr. Fracker has been of a great deal of interest. I have been somewhat surprised that I had a wrong impression in regard to the proposed legislation. The idea that I gathered from the correspondence I had was that we were to have legislation similar to the Smith-Lever Act which would provide for and require state participa-

tion. It seems to me that that is a very good way to get at this proposition, but as I understand Dr. Fracker's outline (if I am wrong I would like to have the impression corrected) this plan does not necessarily call for state participation, and in one respect it seems to me there is a matter of questionable policy connected with the statement.

The question of adequate experimental work to determine efficient methods of control certainly ought to be gone into, but it seems to me that it is hardly the thing to do to combine a regulatory matter and an experimental matter. I may be wrong in my impression of this, but it would seem to me vastly better for us to go before Congress and get adequate appropriation for the Bureau office of Bee Culture to conduct these experiments without tying them up with the regulatory work and get sufficient funds to conduct regulatory work.

MR. FRACKER: With respect to Professor Cory's second point, it would perhaps be best to ask Mr. Calkins to read the bill proposed, as it covers the point of investigations by referring any investigations carried on under this fund distinctly to the Office of Bee Culture Investigations. The object of making it possible to use some of these funds, probably a small amount, for such investigations is that if the Office of Bee Culture Investigations is called on suddenly or without several years' notice for investigations for the determination of points which are necessary in the campaign, it might seriously interfere with the work they were carrying on; whereas if a small portion of the funds for the application of field methods could be diverted to that laboratory for the prosecution of the study of such problems, that difficulty would be solved and the answers to the problems could be provided without delay or without menacing the other problems being studied by the Bee Culture Laboratory.

The first point is purely a matter of policy, that is, diplomatic policy, with respect to the securing of a favorable attitude in Congress on the point. There has been a gradually increasing objection on the part of both legislatures of the states and the members of Congress to measures which include the so-called dollar-for-dollar appropriations. That feeling has been pervading some sections of the country for a number of years; it has been included in Governors' messages to legislatures and at this last session was included by President Coolidge in a message to Congress in which he stated definitely that he would oppose the extension of any project of that kind, I judge for two reasons: first, that it applies compulsory measures to the states in a sense; that is, the legis-

latures feel that they have to adopt these measures; and second, that the distribution of the funds to the states from the Federal Government varies so materially from the proportions in which the funds are received from the various states. There has been a good deal of objection from that source.

In view of the President's message it was felt that the inclusion of a requirement in the bill or in the measure that dollar-for-dollar participation is required would be favorable at the start, and protection of the states' interests it is believed will be maintained by the necessity of state laws for the prosecution of the work. So that there is no possibility in any event of the Federal Department of Agriculture going into a state and carrying on work of this kind where the administration of the State Department of Agriculture, or whatever other organization administers apiary inspection, does not favor the plan applied by the Federal Department.

The law is entirely in the hands of the state administrative officers and until an individual state is convinced of the desirability of such participation, there is no possibility of the Government coming in from above and doing the work.

MR. E. N. CORY: It is a Federal regulatory act you are proposing?

MR. FRACKER: That is correct.

CHAIRMAN HARNED: Is there any further discussion?

The next paper is by Mr. W. J. Nolen.

BROOD-REARING DETERMINATIONS

By W. J. NOLEN

(Withdrawn for publication elsewhere.)

CHAIRMAN HARNED: Is there any discussion of this paper?

The next item on the program is the Symposium on Inspection Methods in Different States. As this symposium was put on by our Secretary, I am going to call on him first to discuss inspection methods in Tennessee. I think it would be well to limit the discussions to three minutes, and if there is no objection we will follow that procedure.

MR. BENTLEY, will you start the discussion by telling us about the inspection methods in Tennessee?

INSPECTION METHODS IN VARIOUS STATES, SYMPOSIUM

SECRETARY BENTLEY: Mr. Chairman and Members: In Tennessee there is very little American foulbrood. The slight infestations which occur in six different yards are being handled satisfactorily and we expect to have a negative showing when the next inspections are made. Tennessee has seventeen commercial queen breeders, and 191,898 colonies of bees located on 30,961 farms. Besides these there are some 200,000 colonies of bees located in the suburbs and larger towns of the State. Tennessee ranks second in the number of colonies of bees kept on farms and seventh in the number of pounds of honey produced annually. Since 1911 $1,000.00 a year has been appropriated for bee inspection service. While there is very little American foulbrood in the State, there does occur considerable European foulbrood and the services of an inspector are needed throughout the year. The next Legislature will be asked to appropriate $5,000.00 a year for a brood disease inspection service in the State.

CHAIRMAN HARNED: Are there any representatives from the New England States here to tell about the inspection methods in those states?

DR. PHILIP GARMAN: I had hoped that Dr. Britton would be present to explain more fully about the inspection methods in Connecticut.

I will say that we have the state divided in two halves, the north and the south half, with two inspectors. Each of these men is a commercial bee-keeper and he is pretty well acquainted with the methods. He conducts the inspection in fairly good shape.

We have a law in Connecticut that provides that all bees should be registered with the town clerk, and in this way we are able to find out just where the bees are located, so that they may be inspected at the proper time.

I can't say exactly how much appropriation we have to carry on this work but I think we have about $1,000 a year.

Our records are all kept at the office of the State Entomologist and are open to inspection by any one who desires to look at them. We now have records in the office which date back as far as 1915, and I think in this point that our inspection is pretty well taken care of.

I don't believe there is anything more that I can say regarding the inspecting in Connecticut, but I will say this: that we don't have enough of an appropriation to cover all the towns as they should be covered.

I think that eventually we will have more money and more men to carry on this inspection.

CHAIRMAN HARNED: Is there any other New England state representative here? (No response.)

Dr. Phillips, will you represent New York?

DR. PHILLIPS: Mr. Paul Liederman is here, who acted as inspector for New York State and I would prefer to have him speak on this matter.

MR. LIEDERMAN: Last summer was my opportunity to inspect, for the first time, in the state of New York.

Regarding the state organization there, the state is divided into two parts, the eastern division and the western division. The western division is under the charge of Mr. Charles Stewart of Watertown, New York, and the eastern division is under the charge of Mr. W. D. White of Altamont, New York. Each of these men are commercial bee-keepers and have had large experience with bees all their lives. Under these men are two or three deputy inspectors, of which I was one, under W. D. White. Under the Civil Service examinations in the state of New York, a man cannot be on the payroll for more than forty days, so that these deputy inspectors are picked to work forty days during the inspection service each summer.

We get word of these colonies of bees and apiaries through the assessors' lists. The assessors are supposed to list the number of colonies kept by each man. These assessors' lists I have found by experience get about one-sixth of the bee-keepers, and as a result we get notice of only about a sixth of the bees in the state.

What we did was to go to a bee-keeper and ask him if he knew about the bees, and he generally did, and we usually followed where our questions led us.

We travel around to these bee-yards and if a man has box hives we give him a box hive order. This box hive order allows a man thirty days in which to transfer his bees to hives of modern construction with removable frames in order that they may be examined. In case the box hive order is not carried out, they are supposed to be destroyed after the thirty day period.

All inspectors have to inspect both box hives and removable frame hives. If it is possible to go in, you are supposed to get a crowbar and get in. In some cases it takes two or three crowbars.

The deputy inspectors go to the box hive yards that have been listed as having foul brood and destroy these, first. That is done in order to clean up as much foul brood as possible. They let the box hive orders where no foul brood is discovered go over until the next season, on account of lack of time.

Next year they are going to incorporate the area clean-up system, which should be an improvement over last summer's method.

CHAIRMAN HARNED: Is New Jersey represented?

MR. CARR: In New Jersey, one man is employed full time for the inspection work and since he can't, of course, inspect bees in the wintertime, that part of the year is devoted to educational work.

Our law is made very broad. It is so framed that any one can do anything which will promote bee-keeping, which I think is quite an advantage.

The amount which is spent in New Jersey for the inspection and educational work is about $3200. We are putting most of the work in places where American foul brood is found, and if there is a continuance of the shipment into New Jersey of infected honey it will mean that the entire state will be in that area because our problem in New Jersey is not the control of diseased material but the prohibition in some manner of the infection coming in from contaminated honey.

I am speaking from the New Jersey viewpoint alone. I have nothing to say about conditions in other states, but we have very little difficulty in cleaning up an area in New Jersey where American foul brood is found, so far as an individual apiary is concerned and its equipment, and preventing a re-infection from movement of diseased fixtures or bees, but we constantly find outbreaks of American foul brood in hitherto uninfected territory which can be traced to no material or bees, and we know that honey is coming into the state because we produce but a very small proportion of the honey which is eaten in our state.

CHAIRMAN HARNED: Is Pennsylvania represented?

MR. E. J. ANDERSON: Mr. Chairman and Fellow-Members: Pennsylvania is rather a large state and has varied conditions. It also is a very bad state for American foul brood and also European foul brood. The disease is well scattered throughout the state and in many sections is quite serious. It is also fortified by being out in districts in the mountains, and in the hands of back lot bee-keepers who are not very well versed in bee-keeping. So Pennsylvania has a real problem in

American foul brood. And to make that worse, they have only a small appropriation there.

We have one man who is permanently on the job at Harrisburg, Charles N. Greene, and during the summer he generally has two deputy apiary inspectors out in the field.

I have been on this job for two years, and we have a double problem. That is, first, the law requires all bees to be in movable frame hives (that law was passed in 1923), and the second law requires the treatment of American and European foul brood, and the inspector has the double job of scouting around and getting the bee-keeper to transfer his bees to removable bee-hives. And of those bee-keepers, we have about ten per cent. They are mostly bee-keepers that are located away from the central districts; they know very little about bees and are very hard to deal with. They don't like to buy new hives and when it comes to foul brood, it is almost impossible in many cases to get in and find the disease.

The deputy apiary inspectors are sent out into the counties and they generally cover two counties a summer. In the counties that have the largest number of bee-keepers and that are mostly infected with American foul brood, where the inspection work has been carried on for several years, the amount of disease has been materially decreased. Otherwise, it seems to be on the increase in many sections, and Pennsylvania still is a large problem in that regard.

CHAIRMAN HARNED: Professor Cory, will you tell us about conditions in Maryland?

MR. E. N. CORY: Mr. Chairman, I can tell you something about conditions, but as for inspection, I can't tell you very much about that.

We have as far as we know only three or four centers of foul brood infection in the state, and our inspection is confined to those who request inspection in order to meet the requirements of interstate commerce.

We have only one man who does any queen breeding and practically all his queens are sold within the state. So that we are largely a closed corporation. We don't produce any honey for shipment out of the state to amount to anything, and we do obtain a good bit of honey from the West and some from the South.

CHAIRMAN HARNED: Professor Schoene, will you speak for Virginia?

MR. W. J. SCHOENE: Mr. Chairman, we don't have any bee inspection in the state of Virginia. Only recently a foul brood law has been enacted. For a number of years the bee-keepers have petitioned the Legislature for a foul brood law and for funds to carry on bee inspection. About two

years ago the bee-keepers decided to ask the state Legislature to pass a bee law providing for a tax on hives, to support the inspection.

The law passed the House and got to the Senate Committee, and then some man from a back woods district said that his county would go Democratic if they passed that law, and they were afraid to let it go by. So they cut out the part of the bill referring to raising the funds and let the other part of the bill providing for the inspection go through. So we have a bee inspection law now, with no funds.

At the next session of the Legislature we propose to ask the General Assembly for funds for bee inspection. We certainly need it very badly in Virginia. I am reasonably certain from the reports that we have received and the few inspections that we have made that both American and European foul brood undoubtedly occur in every county in the state.

CHAIRMAN HARNED: District of Columbia. (No response) How about West Virginia? (No response) North Carolina?

MR. KELLY: I would like to speak for the District of Columbia.

We have, I estimate, between 500 and 1,000 colonies of bees in the District of Columbia, and we have our share of foul brood. I had a good dose of it myself in one apiary.

I took up with Professor Fracker the necessity of including the District of Columbia in the bill for Federal assistance in control of American foul brood. The District of Columbia, of course, could not meet the dollar-for-dollar plan that has been spoken of, for the simple reason that we have no state organization to control us, the same as exists in the country as a whole.

The district geographically is the same as Maryland. Practically all bee-keepers in the District of Columbia are members of the Maryland Association and look to the Maryland Association and Maryland inspectors for whatever assistance they need. We hope though that when this Federal Inspection Service becomes a law the District of Columbia will get some assistance from that source.

CHAIRMAN HARNED: North Carolina?

MR. J. E. ECKERT: Mr. Chairman, North Carolina due to pressure being brought about by the St. Petersburg Association recently through its State Department of Agriculture made a ruling requiring all colonies of bees coming into the state, or those that are to be moved from any one point in the state to another point, to be inspected, and also authorized inspection of all colonies within the state at the desire of

the inspector—that inspection service is to be carried on by the State Department of Agriculture.

However, no funds were appropriated for this purpose, and inspections are made only upon request by bee-keepers, and are conducted by the state nursery inspector who is not a bee-keeper himself, although he has had a preliminary course in bee-keeping.

However, the sentiment there is in favor of better inspection laws and those of us in the state bee-keepers' association who are interested in getting inspection work carried on more efficiently believe that if we can prevent bee diseases from being shipped in from outside of the state, we can control our own problem.

We have American foul brood and European foul brood and one or two other diseases which we have not been able to diagnose. American foul brood is very serious in our mountain counties especially. We have situations there which cannot be controlled, and it has practically destroyed the bee-keeping industry in Madison County which at one time was the leading bee-keeping county.

We had one incident in which we cooperated with the state of South Carolina in this respect. I don't know how many of you have received nuclei from Jesup, Georgia. I hope very few of you have. We did at State College, and we have had foul brood there for some time, until we had destroyed all or treated all of the frames received in the original two-frame nuclei shipment from Jesup, Georgia. It seemed that the parties in Jesup, Georgia had to move from Jesup and they chose to go to South Carolina, on the edge or near the edge of North Carolina. One of the members of our Association notified the inspector in South Carolina of that shipment, after writing to Jesup, Georgia authorities, and they said that they had a perfectly legal permit to ship.

On investigation that permit was found to be illegal, and so they packed up their colonies and shipped them back to Georgia. Whether they shipped them back into South Carolina by another route, or not, I don't know.

The two states are cooperating as closely as possible in controlling bee disease, or in keeping out the American foul brood especially. We have never been able to trace any of the outbreaks of the disease to imported honey, although we do receive a great deal of honey from California, from Ohio, Colorado and various other places where disease exists.

CHAIRMAN HARNED: Is South Carolina to be heard from? (No response) Georgia?

MR. CHAFIN: Mr. Chairman, Georgia produces about $3,000,000 worth of honey annually.

With regard to the apiary inspection work, we keep one full time man on that and two part time men. We employ the same methods in Georgia as they do in Mississippi and Florida. We destroy the colonies and quarantine the apiary whenever American foul brood is found.

CHAIRMAN HARNED: Florida?

MR. JAMES C. GOODWIN: When the bee disease work was undertaken in 1919 along the Apalachicola River, Calhoun and adjacent territory, we had quite a bit of disease. With the cooperation and assistance of the bee-keepers and hard work on the part of the Plant Board, that has been cleaned up, and the work has extended all over the state.

Just offhand, last year I believe we made about 20,000 colony inspections and located twenty colonies of American foul brood. To the best of my knowledge and belief, we only have four colonies of European foul brood in the state, that is, that we have found. Mr. Bartholomew found three of them and I found one.

So from a disease standpoint, we are able to say that things are going very nicely. The wax moth and the careless bee-keeper are the cause of our biggest trouble. In fact, the wax moth is quite a problem with us, as well as the large red ant, especially in the extreme southern part of the state.

I presume the method of inspection has been discussed, wearing the one-piece suit, disinfecting everything when you leave the apiary with bichloride of mercury, and in the event disease is found, disinfecting the hands and anything that came in contact with the bee-hives before proceeding to any other part of the yard. At sundown when all the field bees are in, the bees in the colony are destroyed, using carbon disulphid, chloroform, ether, gasoline or anything we happen to have available. Then the entire hive is destroyed, bees, combs, and everything. And so far we have had excellent results in our work.

CHAIRMAN HARNED: Alabama? (No response) Mississippi—Mr. Lyle.

MR. LYLE: We are fortunate in Mississippi in having American foul brood only in the Delta section. We have found it in the eastern part of the state only in one county, which as Professor Harned stated a few moments ago, came in from Alabama. Last spring we did find American foul brood in another county but it was brought in on a truck from Iowa and we disposed of that.

Our appropriation for bee disease eradication in Mississippi is, I sup-

pose, on the same basis as that in Florida. It is under the State Plant Board and we have a blanket appropriation for our work, but on account of our other lines of activity only a limited amount can be devoted to apiary inspection.

As I stated, we haven't a great deal of American foul brood in Mississippi. I don't suppose we have found more than 400 colonies in a single year and this last year we found, I believe, according to Professor Harned's statements 156 colonies, and at the present time we haven't an infected colony in the state that we know of. Of course, we expect to find some next year.

This is our plan of inspecting there: We inspect every non-infected apiary several times during the year. With one exception (we have one queen breeder who is located in a county where foul brood has been found) our queen breeders are in a section of the state where we don't have foul brood. All queen breeders are inspected each year. We are encouraging the bee-keepers all over the state to report to us every time a bee-keeper moves bees into their community because the experience of this man who came in from Iowa with forty infected colonies has taught us the lesson that we are likely to get American foul brood from anywhere and at any time. He came in in January on a truck all the way from Iowa, so we now expect to find bees coming in from anywhere.

I might say that we have a quarantine regulation in Mississippi which prohibits the movement or shipment of bees or bee-keeping equipment into the state except on permit from the state.

CHAIRMAN HARNED: Louisiana? (No response) Arkansas? (No response) Texas?

MR. THOMAS: Thanks to the efforts of the Texas Honey Producers Association, we have a law in Texas that includes all the good points that are in the plan proposed by the National Foul Brood Eradication Campaign.

In the organization, a chief foul brood inspector has direct charge of the work. There are two deputy inspectors, one a twelve months man and the other a nine months man, and then there are half a dozen local inspectors, usually bee-keepers, that are located in various sections of the state.

We have a good deal of territory, of course, that has to be covered, and so far the inspection work only goes into those sections where foul brood is thought or known to exist. Sixty-three counties were inspected last season and in twenty-three foul brood was found. We have about 40,000 colonies; 411 had American foul brood. All but 11 or 12 of them

were destroyed by fire at the time the inspection was made, and it is only under very exceptional circumstances that they are not destroyed when found.

We allow the men to have automobiles. They will begin next first of February, and inspect the queen breeders; there are forty of them who are inspected first, and if found clean, a certificate is granted. If they are not clean, they are put under quarantine until a later inspection is made. Then they inspect the other colonies of honey producers, taking up the plan of area clean-up. According to the law, they are not allowed to keep box hives or colonies of cross combs, and whenever they are found in this area clean-up inspection they are destroyed. Outside of that area, they are given a certain time in which to transfer them; usually, if they are found in the fall they wait until spring before they are transferred.

We necessarily require a large appropriation and it is a job that goes from the first of February until the first of November, and usually into the middle of November.

CHAIRMAN HARNED: Is Ohio represented? (No response) Indiana?

MR. WALLACE: We, in Indiana, use the bee-keepers I think more than the rest of the states do. We used to depend almost entirely on the inspectors, but we go into each county now and organize the bee-keepers and we find them very willing to help us. They agree to make a list of all the bee-keepers in the county. Then a man from each township who knows where all the bee-keepers live drives the inspector, and I agree to put an inspector in there until they get through with them. We used to make the mistake of sending the inspector all over the state; we didn't keep him in one place long enough. Now I agree to put a man in a county, and if he keeps his health and doesn't have any fights, he stays there until the bee-keepers themselves say they are through with him and then they don't get an inspector again until the fall, until we go back in to see that everything has been cleaned up.

European foul brood has ceased to be any menace to us whatever. In no year does it run more than one-half of one per cent out of about 40,000 colonies inspected. That is simply due to the fact that we are getting good Italian queens all over the state.

American foul brood this year ran almost five per cent out of about 36,000 colonies inspected. In the fall we checked up on all those and found that they had been treated and cleaned up, so that there was practically one per cent of foul brood left when the inspector went around. That will mean, of course, that some of it will get out. We

don't expect to get it down much below four per cent. We couldn't get it down to that basis except with the help of the bee-keepers, and I don't believe the inspectors realize how much work the bee-keepers themselves will do if you will give them a chance and put it up to them. They get our appropriation for us, and they drive the inspector; we don't furnish machines. Sometimes a man will turn in as low as ten and twelve dollars expenses for automobile hire in one month, and he drives every day.

CHAIRMAN HARNED: Is Illinois represented? (No response) Michigan? (No response) Wisconsin?

MR. S. B. FRACKER: The work in Wisconsin is carried on on the area clean-up plan. Seventeen counties are now included within the district. I don't believe there is any further development of the policy.

CHAIRMAN HARNED: Are there any other states represented?

MR. CALKINS: As a background for what I might say, I wish to state that in Wyoming we have only about 425 bee-keepers and we have about 35,000 colonies of bees. So you see that commercial bee-keeping is the rule and not the exception as a means of livelihood of most of our bee-keepers, and their sole means.

We have only seven counties in the state where bee-keeping is of any importance. In all of these counties we have American foul brood. In no instance has there ever been found any European foul brood.

We have a combination of the county apiary inspection system, under the supervision of the state. In other words, the counties themselves pay for the work which is actually done in their own county and the whole system is tied up in administration by the State Entomologist who functions under the Commissioner of Agriculture, in cooperation with the University of Wyoming.

This system has been in use now only two years. We aim, first of all, to inspect the smaller bee-keepers, but we are finding this is impracticable, and as soon as possible we must also inspect the yards of the commercial bee-keepers and extend our work into all sections of the state.

We have thus far succeeded in inspecting about one-third of the colonies in the state each year. In 1923, the infection of American foul brood was 7.5 per cent. In 1924, it had increased to 10.8. This represents an increase in two counties alone. In the other counties we have had a decrease, and these two counties are the ones where most of our commercial bee-keeping is done.

I may say also that we have sac brood. Last year we had, approx-

imately 500 cases shown by our inspection reports, this year somewhat less, about 200.

One of the features of our law is to prevent the interstate shipment of bees on combs and used equipment. That particular feature has been put in under a ruling of the Commissioner of Agriculture during the last month. We are now prohibiting the shipment into Wyoming of bees on full drawn combs and of any used bee-keeping equipment. This will eliminate the importation of the disease; it will limit it to pretty nearly a practical extent because we are shipping out of the state about eighty per cent of our honey and are importing very little.

Our plan for the future is to have a combination of the county inspection system and the area clean-up method. We realize that in the two counties where we have had a tremendous increase of American foul brood during this past year and during several years past that we cannot get at the matter by our county apiary inspection system. For that reason the state Bee-keepers' Association in cooperation with influential legislators have proposed that we have for the coming fiscal year $10,000 for area clean-up work. We shall probably get about $5,000.

In that way we expect to go in and reduce the infection in our worst counties to a minimum, and then have in reserve for all time the apiary inspection system by counties to prevent re-infestation and to supervise the work after it has been reduced to a minimum.

CHAIRMAN HARNED: If there are no other states represented here we will proceed with the report of the Resolutions Committee.

MR. S. B. FRACKER: The Resolutions Committee is reporting two resolutions to be handled separately. The first is:

Be it Resolved, That the Apicultural Section extend its thanks for the efficient cooperation and assistance rendered by Dr. E. F. Phillips while chief of the office of Bee Culture Investigation and assure him of our support in the development of a Department of Apiculture at his present location.

The motion was adopted.

MR. FRACKER: The other resolution is:

Be it Resolved, That the Apicultural Section of this Association express its confidence in the apicultural investigations carried on by the Federal Department of Agriculture and that we recommend to Congress the expansion of facilities for carrying on such investigations, particularly making funds available for studying bee disease control methods and the improvement of regional bee-keeping practice.

The motion was adopted.

CHAIRMAN HARNED: We will hear from the Chairman of the Committee on Nominations, Dr. Phillips.

DR. PHILLIPS: Mr. Chairman, the Committee on Nominations desire to nominate Professor R. L. Webster, of North Dakota, for Chairman of the Apicultural Section, and Professor G. M. Bentley, of Tennessee, as Secretary.

CHAIRMAN HARNED: You have heard the report of this Committee; what is your pleasure?

The motion was regularly seconded and carried.

CHAIRMAN HARNED: Is there any new business to come before this section?

MR. A. P. STURTEVANT: I would like to say just a word about the subject that was taken up at Cincinnati last year with regard to the translation of foreign literature, particularly so far as that has been done on bee diseases. I was not at the meeting at Cincinnati but Dr. Phillips turned some of this work over to me to carry on.

So far we have had rather poor returns. Evidently the members of the Apicultural Section have found that twenty pages of translation is a bigger task than it looked to be when it was first proposed, and we have so far had only four men who have turned in completed translations. We are prepared to carry this on, mimeograph these translations and distribute them and expand this work into other lines after we finish up the bee disease work, and I think that if we could get a little better cooperation among the men who have not finished their translations (and there are several) it would facilitate this work considerably. Just a short while ago I wrote letters to everybody who had agreed to translate and I only received two or three replies to those letters, and most of the letters contained some very good alibi as to why the translations weren't finished. Most of them had made a start.

DR. E. F. PHILLIPS: Mr. Chairman, I would like to urge that this work be carried on, because those of us who are put to the necessity of reading the foreign literature (and that applies to practically all persons engaged in apiculture work) will find it very much better if some of this translation work is done by someone else for us. I have completed my task and therefore I can speak on this matter, and I think there are about four or five others who have, and consequently I have received the translations that have been prepared by others which I have read with interest. To translate twenty pages of foreign literature is a little difficult for some of us but I struggled through it. I got out twenty pages of German which I think entitles me to a badge of merit of some kind. (Laughter)

Most of this work this year is on bee diseases. I think that perhaps the best way to handle it would be to leave it in the hands of the Bee Culture Office because they are carrying the great burden of the work. But while we are here, every one should become familiar with the plan which was proposed and all those who can possibly participate should see that their names are properly recorded on the cards for this purpose and that assignments are made to them. If this is continued for another year, I shall be willing to translate another twenty pages of German, provided a lot more do it too, but this is something which I think we should not allow to be dropped. It is going to be of great value to us all.

MR. J. E. ECKERT: I might say that probably all who would like to participate have not received an assignment. If they will send me an assignment in either French or German, I will try to get it out within the next sixty days.

DR. E. F. PHILLIPS: I move, Mr. Chairman, that the arrangements be left in the hands of the Bee Culture Laboratory and that this work be pushed forward.

This motion was regularly seconded and carried.

There being no further business, the meeting adjourned at 12:15.

Adjournment.

A CONFERENCE OF SOUTH AFRICAN ENTOMOLOGISTS

An account is given in the October, 1924, number of the Journal of Agriculture of the Union of South Africa of a conference of entomologists, including those of several schools of agriculture and of the various sections of the Division of Entomology, which met at Pretoria in August. Among those that were present, of which 19 appear in a full page reproduction of a photograph, are the familiar faces of C. P. Lounsbury, chief of the Division of Entomology, who has just completed thirty years of service, and C. B. Hardenberg of the Department of Agriculture of Lourenco Marques, Portuguese East Africa. Among other entomologists whose names are familiar are Claude Fuller, assistant chief of the Division of Entomology, C. P. van der Merwe and D. Gunn of the Division of Entomology at Durban and Port Elizabeth, and Dr. C. K. Brain of the University of Stellenbosch. The likeness of C. W. Mally, senior entomologist of the Division of Entomology is absent, he having been on a locust expedition to Kalahari. A much better reproduction of this group photograph is found in the Bulletin of Entomological Research, Vol. 15, part 2, November, 1924, p. 209.

W. A. H.

Proceedings of the Section of Horticultural Inspection of the American Association of Economic Entomologists

The Section of Horticultural Inspection of the American Association of Economic Entomologists convened at 1:45 P. M., Mr. E. R. Sasscer, Chairman of the Section, presiding.

CHAIRMAN SASSCER: The Section will please come to order.

Before proceeding with the program I will appoint a Nominating Committee consisting of Messrs. Cory and Garman, to bring in nominations for officers for this Section for the ensuing year.

Unfortunately, the first paper on the program is listed as an address by the Chairman. This will not be an address but will be confined to a few general remarks.

PLANT QUARANTINE, PAST, PRESENT, AND FUTURE

By E. R. SASSCER

ABSTRACT

A brief history of the plant quarantine work of the United States is given, including a short review of the necessity for and efforts put forth to secure the passage of the Plant Quarantine Act. A short resume of the various fields covered by quarantine activities, the type of men employed in this work, and methods of certifying and safeguarding the plants and plant products shipped interstate (including fumigation with Hydrocyanic Acid Gas) is contained in this article; as well as a discussion of the need for more time for the meetings of the Section on Horticultural Inspection and a change in the name of the Section. The suggestion is made that a committee, composed of members of the Section, be appointed to consider these last two problems.

Inasmuch as it is a custom of long standing for the Chairman of this Section to present an address as a preliminary to the reading of the papers on the program, I shall have to request your indulgence for a brief period. It has occurred to me that this is an opportune time to take a hurried stock of the past plant quarantine activities of this country and at the same time consider briefly some of the problems of the future. The advent of the San Jose Scale and the subsequent passage of state laws having for their purpose the prevention of the spread of this pest is a matter of record. In the absence of a federal law regulating the entry of plants and plant products, the efforts of the early plant quarantine officials were concerned mainly with domestic problems, and when time and funds would permit, the examination of introduced nursery stock. In the meantime, insects and plant diseases which are now costing the taxpayers millions of dollars annually, were arriving with startling rapidity.

Appreciating the necessity for protecting the agricultural interests of

that state, California, some thirty-three years ago, established a competent quarantine service at the port of San Francisco, later extending it to other ports of entry where nursery stock and fruits were examined as a condition of entry. The first organized effort to secure national legislation was the result of a conference held in Washington in 1897. Dr. C. L. Marlatt, in his paper entitled "Need of National Control of Imported Nursery Stock"[1] briefly reports the results of the conference referred to above, as well as the subsequent efforts to secure legislation.

The passage of the Plant Quarantine Act of August 20, 1912 furnished the necessary authority to exclude or control the movement of plants and plant products into this country. Under the authority given in this act, twenty-one foreign and fifteen domestic quarantines have been promulgated to date. In addition, numerous state quarantines relating to interstate movement of plants and plant products have been declared.

The growth of regulatory work since the passage of the Plant Quarantine Act has been phenomenal. Fortunately for all concerned, the day of employing officials totally unqualified to meet the problems constantly arising in connection with regulatory work has passed; and we now find this work rapidly being placed in the hands of those who appreciate the need for carefully designed laws and their proper enforcement. Regulatory work, as we now know it, has passed the mere policing stage and requires men of vision and training, not only in its administration, but on the part of all who engage in it. To cope with the problems constantly arising in connection with plant quarantine work requires the aid and assistance not only of Plant Quarantine Inspectors, but of qualified entomologists, plant pathologists, horticulturists, chemists, nematologists, bacteriologists, attorneys, diplomats, and men of sound administrative ability. To this list must also be added the explorer who visits various countries to determine by painstaking inspection, and in frequent instances, hardship, whether or not the entry of certain products into the United States from a given country is attended by the risk of introducing additional pests. Not only are we making an effort to bring together complete information on the insects in the country of origin which may be introduced in plants and plant products, the entry of which is now permitted, but we have access also to the very excellent records which are now being assembled by the Insect Pest and Plant Disease Surveys of the Bureaus of Entomology and Plant Industry in cooperation with the various state and federal officials. As a result of these surveys, we

[1]Jn. Ec. Ent., Vol. 4, No. 1, p. 107, 1911.

are rapidly assembling accurate information on the distribution of insects and plant diseases, both native and introduced.

The quarantines now in force, both state and federal, regulate the movement not only of nursery stock, but of practically all products entering into agricultural commerce; and hence it is important that the laws so affecting the movement of these products be just and to the best interests of our agriculture. If the existing quarantines are inadequate to meet the situation, prompt steps should be taken to secure the necessary protection; conversely, if there are on the statute books laws which are not accomplishing the desired purpose, they should be repealed.

One of the great problems now confronting quarantine officials is the securing of well trained inspectors. Judging from the examination papers which have come under my observation for the past few years, it is obvious that many of the colleges are failing to impress upon the students who propose to enter the plant quarantine field the necessity for careful preparation. Not only must these men be well prepared along agricultural lines, but it is essential to the success of the work that they be tactful and men of vision. No longer have we need for the man who is merely looking for a job. In brief, we must demand the highest order of integrity and ability in our quarantine officials who are to grapple with the problems of the present and the future. In the words of the late Theodore Roosevelt, "The man must be glad to do a man's work, to dare, and endure, and to labor."

It has been apparent for a number of years that our method of certification demands attention; and this subject has been under consideration by a committee of this section during the past two years. Too often is it the case that plants and plant products are shipped under certificates which are totally misleading, certificates which do not convey the essential facts, certificates which are unfair to the consignor, the consignee, and to the quarantine guardian of the state in which they are received.

The methods which have been used in the past for the purpose of safeguarding plant material as a condition of shipment into a given area have received inadequate attention. For many years fumigation with Hydrocyanic Acid Gas was considered a satisfactory method of disposing of insects to be found on nursery stock and other plants and plant products. In fact, it appears that for a time it was assumed that Hydrocyanic Acid Gas would naturally kill any insects which might be present; and plants were allowed to be shipped, after such fumigation, with the feeling on the part of the officials concerned that after such treatment the plants were safe for distribution. In the light of recent experimental work, it

is quite obvious that Hydrocyanic Acid Gas, or any other gas of which we have knowledge, under reduced temperatures is not effective on insects infesting nursery stock. This condition, which may well apply to any fumigant used to disinfect plants or plant products for distribution or as a condition of entry, illustrates forcibly the need for very careful experimentation under varying conditions to determine whether the fumigant concerned can be relied upon as effective, not only under experimental, but under commercial conditions as well. The mere fact that we have not as yet found a fumigant which is entirely satisfactory should not prevent further investigation, not only with fumigants, but with heat treatment.

This would seem to be an opportune time to consider the future of this section. Our annual meetings have been a source of inspiration to us all. The personal contact and the exchange of ideas have done much to increase our enthusiasm in the work we have to perform. The number and intricacy of the problems which now demand our attention are much too great to be given even casual consideration in the brief period which the Association of Economic Entomologists has so generously granted this section. The better understanding which resulted from the conference with state and federal officials last April is one of the outstanding accomplishments of the year about to close. Our associates in the west, through the medium of the Western Plant Board which holds annually meetings lasting from two to three days, have demonstrated the wisdom of getting together for the purpose of coordinating their quarantine work and considering at length if desirable, any problem relating to interstate shipment of plants and plant products. In view of the constantly increasing growth of quarantine activities in this country as they relate to foreign, interstate and intrastate movement of agricultural commerce, it is patent that we should strive to have more representative meetings and devote more time to the mutual consideration of our problems. I am frank to admit that I do not look with favor on the separation of this section from the Association of Economic Entomologists, but I do not see how we can consistently request more of that association's time which, as you well know, is always crowded. Possibly we could convene prior to or immediately following their meetings, or perhaps it would be more convenient, and at the same time, more profitable to hold the meetings of this section at another season of the year. In this connection, it would also be well to consider the desirability of changing the name of this section, since our activities are not now limited to horticultural inspection, but cover a much broader field.

It would therefore appear desirable to appoint a committee composed of members of this section to give these matters immediate consideration, in order that steps may be taken, either jointly with the American Association of Economic Entomologists, or independently, to provide for more time to be devoted to the future meetings of this section.

Finally, I urge closer cooperation on the part of all officials engaged in plant quarantine work. We are working toward a common end; namely, the protection of American agriculture. We should make it a point to discuss freely the problems encountered in the administration of our work. Permanent and lasting results will be gained only by the cooperation described by Kipling:

"It ain't the guns nor armaments
Nor funds that they can pay,
But the close cooperation
That makes them win the day.

It ain't the individuals
Nor the army as a whole,
But the everlasting teamwork
Of every bloomin' soul."

CHAIRMAN SASSCER: We will hear from Dr. Marlatt on "Recent Work of the Federal Horticultural Board."

RECENT WORK OF THE FEDERAL HORTICULTURAL BOARD

By C. L. MARLATT

ABSTRACT

The various activities of the Federal Horticultural Board during 1924 were outlined in a brief way, and the difficulties which had been encountered were mentioned. Some of the quarantines in force were enumerated and discussed, particularly the recent Fruit and Vegetable Quarantine. In this connection, the explorations of Messrs. W. M. Mann and G. F. Moznette in several countries, to determine freedom from the Mediterranean Fruit Fly and from other species, were mentioned. The increase in the amount of work to be done at the various ports was touched on and also the difficulties of securing adequate funds for carrying out the Board's activities. Reference was made to the Conferences which had been held in Washington for the purpose of discussing quarantine problems.

CHAIRMAN SASSCER: Dr. Marlatt's paper is now open for discussion.

MR. MAX KISLIUK: Just before I left Philadelphia, I had word through the newspaper exchange that a shipment of apples from Spain to Cuba

was rejected and sent back on account of Mediterranean fruit fly, thus showing that in addition to grapes, apples from Spain are being rejected by Cuba.

CHAIRMAN SASSCER: If there are no other comments we will proceed to the third paper on the program.

THE CAMPHOR SCALE SITUATION

By H. K. PLANK, *New Orleans, La.*

ABSTRACT

The camphor scale, *Pseudaonidia duplex* (Ckll.), was first recognized as a pest in the United States in 1920, when it was found severely infesting camphor-tree, common camellia, sweet olive, and a number of other plants in New Orleans. It was doubtlessly introduced directly from Japan at this point and at Mobile, Alabama, and Alvin, Texas, on ornamental and citrus nursery stock. It has also been seen a number of times elsewhere on plants consigned for entry into the United States from Japan.

This scale has been found on approximately 150 different species of plants in numerous places in Alabama, Mississippi, Louisiana, and Texas; but it has now been eradicated in Mississippi. Of these hosts, camphor-tree, Japanese persimmon, sweet olive, common camellia, Satsuma orange, rose, Japanese honeysuckle, common fig, confederate jasmine, and glossy privet seem to be the most preferred. While the susceptibility of the different hosts is quite variable, the scale seems to cause the most injury to Japanese persimmon, camphor-tree, sweet olive, Satsuma orange, common camellia, certain roses, and Japanese honeysuckle, all of which are seriously disfigured, or partially killed, by prolonged attack.

The presence of the camphor scale in the Alabama citrus district makes it very important from a commercial standpoint. Here it ranks with the purple scale in its ability to spot the fruits about the time they ripen and thus to reduce considerably their market value.

The camphor scale seems to be well controlled by most oil sprays. It is recommended that all heavily infested trees except citrus and very tender plants be pruned and then sprayed once in the fall and again in the early spring with a heavy lubricating oil emulsion so diluted as to contain 2% of oil. Citrus and other tender plants in some of the Gulf states should receive the same treatment but light lubricating oil emulsion should be used, so as to avoid as much as possible the risk of spray injury. Two additional "summer" applications are sometimes recommended using 1% heavy oil emulsion for the more resistant plants and 1% light oil emulsion for such as citrus and other tender plants. The first of these applications should be made about May 15 and the second about July 30 to control the immature scales of the first and second broods, respectively.

If fumigation with hydrocyanic acid gas is employed, ¾ oz. av. of sodium cyanide in 2½ fl. oz. of water and 1⅛ fl. oz. of sulphuric acid should be used for each 1000 cu. ft. of space at an exposure of 1 hour when the temperature is 80°F. or above. When the temperature is below 80° F., 1 oz. av. of sodium cyanide in 3 fl. oz. water and 1½ fl. oz. of sulphuric acid should be used for this space at the same exposure.

The camphor scale[1] situation this year (1924) has assumed a somewhat different aspect as compared with that which it presented when the scale was first discovered at New Orleans, La., on camphor trees by Ed. Foster, of the Federal Horticultural Board, on August 4, 1920. Shortly after that time the only infested area found by a somewhat hasty survey was located in the southwestern quadrant of the city, and the infestation was most intense in and about a nursery for ornamental trees and shrubs, in which the original specimens were taken. Subsequent scouting, however, revealed the camphor scale on numerous plants scattered over most of the city and in a few outlying sections to the north and west, and indicated that it might have been present for some time.

A more or less thorough search for this pest in the Gulf States and in other States known to have received shipments of host plants from New Orleans and Texas nurseries has since been made by the United States Bureau of Entomology and the Federal Horticultural Board, in cooperation with the authorities in these States. As a result of this work the scale has thus far been found only in the States of Alabama, Mississippi, Louisiana, and Texas. While it has been intercepted a number of times elsewhere on imported plants by both State and Federal authorities, so far as known it does not now occur outside of the States of Alabama, Louisiana, and Texas.

History and Present Status of Infestations

Alabama. The first known occurrence of the camphor scale in Alabama is at Grand Bay, where its origin has been traced to citrus stock and figs imported directly or indirectly from Japan and planted about 1911 by a branch of the Alvin Japanese Nursery, then located near Alvin, Texas. It was first reported from this point on Satsuma orange and fig by W. W. Yothers, of the Bureau of Entomology in July, 1922. The infestation shortly afterwards was found to extend over relatively large portions of the East and Potter tracts of the Grand Bay Land Co. and on a number of other properties in that vicinity. The severe weather of last January, when the temperature went to about 14° F. on at least one occasion, completely killed about 50% of the Satsuma trees in that section, and only a few specimens of the camphor scale can now be found in this general locality, these occurring principally on nearby plants such as figs and camphor-trees.

Another infestation was later found about 5 miles south of Mobile in a Satsuma orchard set out by a local Japanese nursery from stock imported from Japan. Here the infestation was confined to half of the

[1] *Pseudaonidia duplex* (Ckll.)

27-acre tract, but was quite severe until the freeze of last January killed nearly all the trees. At present the few remaining Satsumas and some small wild persimmons growing along the fence rows are rather heavily infested.

The last infestations found in Alabama were both in Satsuma groves; one at Belfontaine, on the edge of Mobile Bay, about 12 miles south of Mobile, and one near Irvington, about 10 miles east of Grand Bay. Both infestations were small when first reported and are believed to have spread from the others just mentioned. The one at Belfontaine is now quite extensive, although light; that near Irvington is reported still to be very light. So encouraging is the situation in Alabama, as a result of the freeze, that eradicative measures have been inaugurated by the Division of Plant Industry of that State.

MISSISSIPPI. Shortly after the camphor scale was found to be so abundant in New Orleans, the State Plant Board of Mississippi went over its records of shipments of plants received from New Orleans during several years just preceding. As a result of their inspection and a general search for the pest, it was found and promptly eradicated at Biloxi, Hattiesburg, Jackson, and Pass Christian. The properties on which they were found have frequently been inspected since then and no scale has been found; so it is believed that the camphor scale does not now occur in Mississippi. In this connection, however, it should be mentioned that a number of plants are often carried from New Orleans by commuters and set out around their homes along the Gulf Coast, and that there is thus a possibility of the scale becoming established in this way in spite of the constant vigilance on the part of the Mississippi Plant Board.

LOUISIANA. The first occurrence of the camphor scale in Louisiana, as previously stated, was at New Orleans, where it is supposed to have been introduced in some shipments of Japanese plants; among them the common camellia, a preferred host, imported by some local nurserymen for trade purposes. Here it is still very abundant, particularly in and about the area originally found infested some years ago. The Parking Commission of that city, however, following the advice of the Bureau of Entomology, is now doing some very satisfactory systematic spraying of the street trees, chiefly camphor. If this continues, and if the infestations on private properties receive similar attention, the situation here may soon be considerably modified.

The scale is also still abundant on wild and cultivated plants along the Jefferson Highway leading through the wooded country as far west as

Destrehan, on the left bank of the Mississippi River, some 15 or 20 miles from New Orleans, and on some oranges, figs, and roses near Waggaman, on the right bank of the Mississippi River and about 10 miles west of New Orleans.

One of the earliest infestations to be reported outside of these areas was at Baton Rouge, on a *Camellia japonica* bush which came from a nursery located near New Orleans. This infestation was promptly eradicated, and careful inspections made since then have all been negative.

Other infestations in Louisiana which are of considerable importance are located at Hammond, Gentilly, Jennings, and Lake Charles, all in the southern part of the State, the last three being in nurseries. One was also found at Lorraine, near Hammond, but was eradicated. The only infestation thus far located in the northern part of the State is in Rayville, where the camphor scale occurs in very small numbers on a group of isolated camphor trees about 8 to 10 feet in height. Rayville is also the most northerly point where this scale is known to occur in the United States.

TEXAS. The infestations thus far discovered in Texas center in Alvin, near where the Alvin Japanese Nursery, which imported citrous stock and numerous other host plants from Japan, was in operation until about 1917. The freeze of that year and the discovery of citrous canker on the premises forced the original owners out of business, and the property has since been used mostly as a stock farm. Careful inspections have revealed the camphor scale scattered practically all over the 500 acres formerly occupied by this nursery. The scale now occurs here in only very small numbers on camphor trees in old nursery plots and in the fence rows which bound the 5- and 10-acre tracts into which the place was originally divided. It has been found on other hosts also, some located so near wild undergrowth and woodland that it doubtless occurs there also.

This nursery sent shipments of camphor-trees and other host material into twenty-two States, some of its shipments going to every section of the United States. A great number of plants were also sold locally. The shipments of camphor-trees, as we gather from the very incomplete records now available, have nearly all been traced, and, fortunately, no infestations have, so far as we know, become established from these outside possibly the State of Texas. A number of properties supposed to have received camphor-trees from this nursery have been examined in

the vicinity of Alvin and Arcadia, with the result that the camphor scale was found, but in very small numbers, on seven different premises.

As the result of tracing plant shipments from New Orleans to Texas, two additional infestations were found, one in a small nursery in the city of Alvin and another in Houston. The former has now been eradicated by the destruction of the few plants which were originally found infested, but the latter, formerly very small, was found last summer to have spread considerably. Control measures tending towards eradication of the Houston infestation are now in progress.

Not all plant shipments originating in New Orleans and Alvin nurseries have yet been traced and examined. It is therefore possible that more infestations may be located when all the State agencies have completed the inspection of the shipments to their respective States.

Plants Attacked, Injury, and Importance

Thus far some 150 different species of plants have been found infested with the camphor scale in the States just mentioned. Of these, camphor-tree, Japanese persimmon, sweet olive, common camellia, Satsuma orange, rose, Japanese honeysuckle, common fig, confederate jasmine, and glossy privet seem to be the most preferred hosts. While the susceptibility of the different hosts is quite variable, the scale seems to cause the most injury to Japanese persimmon, camphor-tree, sweet olive, Satsuma orange, common camellia, certain roses, and Japanese honeysuckle, all of which are seriously disfigured, or partially killed, by prolonged attack.

Of paramount importance is the relation of camphor scale to the citrus industry, since the ravages of this scale may be compared in some degree with those of the purple scale with which it is often associated. Like the purple scale, it is active over a large part of the year and attacks all green parts of the citrus tree, although somewhat less severely. The greatest loss is caused by the infestation of the fruits at about the time they ripen, since they are thus rendered unfit for the general market. The reduction in the salable crop of Satsuma oranges in the Grand Bay district of Alabama in 1922, as estimated by Dr. W. E. Hinds, then State Entomologist of Alabama, was 10 to 12 carloads, caused by the infestation of the fruit by the camphor scale and purple scale combined. This reduction was based on a conservatively estimated total crop for that district of 100 carloads. The loss named does not, of course, include the injury resulting to the trees themselves or the consequent decrease in future production.

Taking into consideration the cold weather experienced during January, 1924, in the southern part of some of the Gulf States, where mini-

mum temperatures were recorded ranging as low as 14° F., and, on at least one occasion, 10° F., at Rayville, in northern Louisiana, the camphor scale seems able to survive relatively severe weather conditions, since only about half of the live scales were found to be frozen in the southernmost localities. In Tokio, Japan, and its general vicinity, where this scale has been established for some time, perhaps somewhat colder weather than this has been experienced, sometimes accompanied by snow. In view of these facts it seems likely that the camphor scale might be able to live and reproduce itself, and possibly become a troublesome pest, in favored localities some distance to the north of its present limits in the United States. It also seems possible that this scale might thrive under greenhouse conditions almost anywhere in the United States on such woody plants as common camellia, tea, and certain species of azalea.

While the wind plays some part in the local dissemination of the scale, the movement of infested plants is without doubt the greatest means of distribution. Thus far no relation of the Argentine or other ants to the camphor scale crawlers has been found similar to that which these ants maintain to mealybugs and aphids in this region. The Argentine worker ants, however, have been observed to pick up and carry loose coverings and detached females when these were placed in their paths, or otherwise encountered.

Summary of Results of Control and Restrictive Measures

Spraying. The camphor scale in all its stages seems to be well controlled by most of the oil sprays. In laboratory tests all females, including all the eggs and crawlers beneath the scale covering, have been killed by a 2 per cent as well as a 3 per cent solution of a heavy oil emulsion, made according to the standard formula for boiled emulsion of 2 pounds of potash-fishoil soap, 1 gallon of water, and 2 gallons of oil. Very satisfactory control of adults and immature scales in light to moderate infestations has also been secured by the use of heavy oil emulsion 1 per cent and of light oil emulsion both 1 per cent and 2 per cent, but not all the eggs and crawlers were killed by these three emulsions. Practically the same results have been obtained in demonstration spraying experiments in which large camphor-trees were used.

It has therefore been recommended, especially in "clean up" or eradication work, that all heavily infested trees, except citrus and very tender plants, be pruned and then sprayed once in the fall and again in the early spring with 2 per cent heavy oil emulsion. Citrus and other tender plants in some of the Gulf States should be sprayed with a 2 per cent solu-

tion of light oil emulsion, so as to avoid as far as possible the risk of burning. On nearly all fruit trees, especially citrus, this should bring a rather heavy infestation under such control that the regular oil-and-sulphur spray schedule used in most well-cared-for citrus groves will have considerable effect in holding the camphor scale in check and in preventing injury. The benefit to be derived from this schedule would seem to be greatly increased if it included 2 "summer" applications of 1 per cent light oil emulsion which is preferably so made that it will mix with lime-sulphur, since this latter material has been shown by W. D. Whitcomb of the Bureau of Entomology to be very effective in preventing the settling of camphor scale crawlers. The first of these applications should be made about May 15 and the second about July 30, to control the immature scales of the first and second broods, respectively, since at about these dates the majority of the insects are easily killed by most 1 per cent oil mixtures.

In heavy infestations on more resistant plants, it would be well to apply these two summer sprays also, but heavy oil emulsions can safely be used. A solution containing 1 per cent of oil is generally recommended, as stronger ones are apt to cause burning and excessive defoliation.

FUMIGATION. Fumigation experiments, while apparently satisfactory for practical purposes, have not all given absolutely 100 per cent kill of every stage. Tests made by C. A. Weigel, of the Bureau of Entomology, Mr. Whitcomb, and the writer have included all together a total of 9704 adult female camphor scales which were exposed for 1 hour to the gas from dosages of sodium cyanide ranging from ¾ ounce avoirdupois to 2 ounces, apothecaries weight (2.194 ounces avoirdupois) per 1,000 cubic feet, at temperatures ranging from 42° F. to 96° F.

In these tests 99.89 per cent of the number of scales treated were killed. The eleven scales remaining alive were found in the following tests: two at ¾ ounces avoirdupois at 42°, six at ¾ ounces avoirdupois at 66°, one at 1 ounce avoirdupois at 90°, and two at 1 ounce apothecaries weight at 81°. All these scales were apparently normal and showed no conditions which might account for their not having been killed by these treatments.

Experiments in the control of the camphor scale by the use of calcium cyanide dust, with dosages from ¾ ounces avoirdupois to 1½ ounces avoirdupois per 1,000 cubic feet with an exposure of 1 hour have given unsatisfactory results. In eleven experiments with these dosages at temperatures ranging from 62° F. to 88° F., all adult females were killed in only two tests, 1½ ounces avoirdupois at 74° and at 77° F. However,

at this dosage live scales were found which had been fumigated at 62° and 88° F. The mortality in the remainder of the experiments varied from 76.36 per cent when ¾ ounces avoirdupois was used at 77° F., to 99.53 per cent, when 1 ounce avoirdupois was used at 74°F.

The mortality of eggs and crawlers resulting from fumigation has also been quite variable. In eight experiments by Mr. Whitcomb and the writer, infested potted camphor-trees were fumigated for 1 hour with hydrocyanic acid gas from dosages of sodium cyanide ranging from ¾ ounces avoirdupois to 2 ounces apothecaries weight per 1,000 cubic feet, at temperatures ranging from 47° F. to 96° F. only a few crawlers out of the thousands counted were found alive in four experiments within 2 weeks after fumigation. These were treated with ¾ ounce avoirdupois at 90° F., ¾ ounces avoirdupois at 77° F., ¾ ounce apothecaries weight at 87° F., and 2 ounces apothecaries weight at 47° F. The other four treatments, in which 1 ounce avoirdupois, 1 ounce apothecaries weight, 1½ ounce apothecaries weight, and 2 ounces apothecaries weight were used at 96°, 81°, 83° and 50° F. respectively, seem to have been entirely effective in killing all stages.

The gas generated from sodium cyanide used at the rate of 1 ounce avoirdupois per 1,000 cubic feet seems to give in one hour at 80° F. sufficient penetration in the ordinary fumigation box to kill all adult females on plants wrapped in 1, 2, 3, and 4 thicknesses of newspaper. This dosage, however, was not effective in killing all the eggs, as a large number were alive and hatched on all wrapped plants, even those enveloped in one thickness of newspaper. Three thicknesses of newspaper seemed to give as much protection in this regard as four.

Since many host plants which are shipped from the infested areas will not endure, under all conditions without considerable injury, 1 ounce avoirdupois or more of sodium cyanide per 1,000 cubic feet, the use of ¾ ounce avoirdupois has been recommended from a practical standpoint only when the temperature at the time of fumigation is 80° F. or above. When the temperature is below this point 1 ounce avoirdupois should be used. For each avoirdupois ounce of sodium cyanide, 1½ fluid ounces of sulphuric acid and 3 fluid ounces of water should be used.

In the past 7 years the efficacy of these treatments has been observed a number of times during the tracing and inspection of plants shipped from New Orleans and vicinity. Since the establishment of a State quarantine in Louisiana on May 15, 1921, which included the parishes of Orleans and Jefferson, all consignments of host material to be moved

from the infested areas have, as a final safeguard, been treated according to the foregoing recommendations.

CHAIRMAN SASSCER: Mr. Plank's paper is open for discussion.

MR. F. M. O'BYRNE: I would like to ask Mr. Plank what results were secured with fumigation.

MR. PLANK: Our experiments along that particular line were confined to camphor scale. We didn't run any susceptibility tests along that line.

MR. WEIGEL: Have you had occasion to observe the results of commercial fumigation on a large scale?

MR. PLANK: Only to find in every case that we have not secured 100 per cent kill of the females or of the immature stages. Our experiments have covered approximately 10,000 females and indicate a 99.98 per cent kill.

MR. O'BYRNE: Do you think it would be safe to permit the shipment of infested plants by subjecting them to fumigation with this three-quarters of an ounce dosage?

MR. PLANK: To be perfectly safe, no. The Louisiana State Department of Agriculture makes it a common practice to inspect all the plants which are shipped out, and if there are just a few scales on them they hand-pick those scales and then fumigate the plants. Of course, there is a possibility of missing some scales.

MR. BILSING: I would like to ask Mr. Plank whether the infestation on pecan is on nursery stock or native trees.

MR. PLANK: So far it has been found only on trees growing in the orchard.

CHAIRMAN SASSCER: Are there any other questions? If not, we will proceed with the next paper on the program. I might say at this time that it was not the intention of the Secretary to limit the program to Federal employees. Doubtless there are many plant quarantine problems arising in the various states which should be brought to the attention of this Section, and I hope that in the future at least we will hear from our state plant quarantine officials.

We will next take up the paper by Mr. Rogers.

THE METHODS EMPLOYED IN ENFORCING THE GIPSY MOTH AND BROWN TAIL MOTH QUARANTINE

By D. M. ROGERS, *U. S. Bureau Entomology, Boston, Mass.*

The Moth Quarantine is No. 45, domestic, promulgated by the Federal Horticultural Board. The work is carried on under the division, "Preventing Spread of Moths," of the Bureau of Entomology, U. S. Department of Agriculture.

The organization for the moth quarantine project consists of the Administrative Officer in Charge, an assistant, a clerk for office work, and 32 inspectors, with such additional inspectors as are necessary in rush seasons at the nurseries and the Christmas tree shipping time. Most of the men for the emergencies are loaned temporarily by other branches of the moth control work. It would be impossible for the quarantine work to function without this assistance to carry on at the peak of the load unless a large force was carried through the year, as competent men cannot be brought together for periods of one to three months' employment.

The moth infested area is divided into sections as indicated on the map, with one inspector in each section. In the four western sections the acting inspector is employed as a general foreman in the extermination and control project also.

The greater part of the area of the New England States is infested with the gipsy moth, and a much smaller area, including parts of Maine, New Hampshire, and Massachusetts, is infested with the brown-tail moth, as indicated on the map. The gipsy moth infested area is divided into two areas, designated as "generally infested" and "lightly infested."

The movement interstate of plants and plant products and stone and quarry products from the infested areas is forbidden, except when inspected and certified as free from these insects. The unrestricted movement of the above products from one point to another within the same area is allowed, but certification is required for the interstate movement of these products from the generally infested to the lightly infested area, just as is movement interstate from the lightly infested to points outside either area.

The one exception to the last statement is that Christmas trees and greens, originating in the gipsy moth areas, may *not* be moved interstate from the generally infested area.

The inspection of Christmas trees and greens is one of the difficult problems. Both the office and field men try to get all the information possible as to shippers, points of origin, quantities, and dates for beginning inspection as far as possible in advance, so that preparation for handling the volume of business may be arranged for. The shipping of Christmas trees is mostly in the hands of a few large dealers. About a dozen men handle most of the business north of the Ohio and east of the Mississippi Rivers. These men cut most of their trees in New England and Canada; buy from smaller operators and know the markets. White

spruce (*Picea canadensis*) and red spruce (*Picea rubra*) are favored in some cities, and balsam fir (*Abies balsamea*) in others.

There is no commercial production of Christmas trees in Rhode Island or Connecticut, although southern and western Connecticut does produce large quantities of mountain laurel (*Kalmia latifolia*), which must be certified before shipment. This material is cut or broken from the plants 18 to 30 inches long, and tied in bundles, or smaller stems 6 to 12 inches are stuffed into gunny sacks for shipment. A large part of the laurel is made into wreaths and roping for Christmas decorations, but some is in the markets throughout the year, being gathered at all seasons, and is often kept in cold storage for long periods.

There have been inspected during the past three months about 150 carloads of spruce, fir, and hemlock boughs, cut from the trees, and baled in much the same way as is hay. This seems to be a product marketed only from western Massachusetts at present. A considerable part of this material is retained in cold storage and used in cemeteries for lining freshly dug graves to hide the earth from view. The inspectors examine these boughs at the baling presses.

The 1924 season has been the greatest we ever have had for Christmas tree and green inspection; nearly 900 carloads, besides several hundred smaller lots, have been certified; probably about 2,000,000 trees, or 20,000 trees for each of 100 inspectors that were on the job. Every tree has been carefully examined; usually, the inspector handles and turns all sides of the tree to view, but occasionally the larger trees are stood up on their butts by the owner and turned about for the inspector to see every part.

In most instances, two or more inspectors work together. One shipper in Vermont offered 30,000 trees in one pile for inspection; in Massachusetts one shipper offered a carload of laurel. Either of these lots might almost discourage even a gipsy moth inspector, if he faced such quantities alone.

In addition to inspection of products offered for inspection, it is necessary to visit freight and express receiving stations to see that goods are not moving contrary to the quarantine regulations.

Forest products—lumber, firewood, poles, railroad ties, etc., requiring moth certificates, are usually inspected as loaded on cars or boats. Small lumber and pulpwood or firewood is usually handled, piece by piece, by the inspector, and all sides examined. Heavy timber and railroad ties are handled by shippers, the inspector working only with his eyes. Piling

and telephone poles are usually loaded by derrick or gin-tackle, the inspector walking alongside the sticks as taken off the ground.

The inspection of nursery stock is generally made at the packing-shed of the nursery. In some instances, inspection of plants is made in the field as digging goes on; each plant is handled and inspected separately. If the plants are shipped in cases, the package is as carefully examined as the contents. Poles, frequently placed in bundles to prevent breaking of slender trees, are also carefully inspected.

All inspectors are instructed to say to shippers that in addition to enforcing Moth Quarantine No. 45, they are also to see that other Federal quarantines are not violated; such as, Quarantine No. 26 (Five-leafed Pine and Ribes); Quarantine No. 38 (Berberis, which might carry black stem rust of wheat); and Quarantine No. 53 (Satin Moth).

Most of the Federal moth inspectors are Deputy State Nursery Inspectors for issuing State tags to parties making small occasional shipments, but not having State certificates as nurserymen.

The moth inspectors are expected to inform occasional shippers of regulations in the State to which they are sending plants, but do not assume the right to refuse Federal tags because any such State regulation is being violated.

Stone and quarry products are offered for inspection in great variety; rough field and quarry stone, both small pieces and huge blocks, which must be examined on all sides; paving blocks, which are sometimes cut at small quarry openings surrounded by brushland and likely to be infested by the gipsy moth, must be handled and all six faces examined. It should be stated that most of the paving is cut where there is little danger and is not a commodity which is transported long distances. Monumental and building granite, both rough and finished, is an important product of New England, and great quantities are certified daily. Marble and slate are also produced in great volume within the quarantined area, but generally is partly manufactured before shipment. It is quite as necessary to inspect the car-stakes and wooden blocks used in packing the stone on flat cars as to see that the stone itself is clean. In fact, more gipsy moth egg-clusters are found on the stakes and blocks than on the stone. Cut and finished stone is frequently crated for shipment. The inspector must inform himself as to origin of crating stock, and often finds it necessary to inspect carloads of this material on its arrival at the quarry.

Permit tags are issued by the moth inspectors for material originating outside of the moth areas, but being re-shipped from points within the

areas. To illustrate, a shipload of southern lumber arrives in Boston for a Vermont destination; obviously, it is not necessary to inspect and certify it as free from gipsy moths, so a permit is issued instead.

Besides the products specifically named in Notice of Quarantine No. 45, the inspectors arrange with freight agents to hold shipments and notify inspectors when any material is offered for shipment which they think might be gipsy moth carriers. In this way, cattle and poultry crates, reels on which telephone cables are wound, iron rails taken up from abandoned rail roads, contractors' tool-boxes and apparatus used on construction jobs, are held until certified. Helpful co-operation is the rule.

It is the duty of the shipper to notify the inspector that his services are needed, although common carriers frequently send notice that they have received goods and certificates are required.

In addition to the tag which is attached to the package if shipment is made by freight or boat and a bill of lading or waybill issued, the inspector also issues a certificate to accompany waybill, so that on examination of ships' papers or conductors' papers there is evidence whether the shipment is moving in accordance with the regulations or not. This certificate is often rubber stamped upon the waybill, but signed and dated by the inspector.

A report of inspection is made out at the time of issuance of certificate, showing name of consignor, what was shipped, quantity, name and address of consignee, when shipped, and by what carrier. These reports are sent to the Boston office daily. Copies of these reports are mailed the following day to the State inspector at destination of shipment, and he should receive the notice in time to re-inspect, if he thinks desirable.

There is considerable movement of material for which inspection is required by motor truck. Usually, an inspection tag is issued to the driver.

The moth quarantine regulations provide for the disinfection by heat or otherwise of such products as are nearly impossible of inspection; such as, kindling wood, sawdust, and shavings.

It is required that nurseries shall have valid State nursery inspection certificates before Federal certificates will be issued.

It is also required that surroundings of quarries, lumber yards, and other places from which shipments of contraband material are moved, must be kept clean and free from moth infestation, or certificates may be refused. It is required that cars, boats, and other vehicles used for

transporting quarantined products within the moth area be cleaned of rubbish, bark, etc., before removal from that area.

A map of the New England States, showing the areas affected by the moth quarantine, is issued each year in July. The inspectors deliver or post in all freight, express, and Post Offices, one of the maps, with their name and address for the convenience of the public. Shippers are also supplied with maps on request.

The legend on the map is a brief statement of the regulations under Quarantine No. 45, and if read carefully, will be found to furnish an answer to almost any question relative to the shipment of commodities out of the areas quarantined.

It is busy work seeing that all these regulations are operative. Generally, the people are in sympathy with the effort. When some one slips, it is usually carelessness and not an intentional infraction of the rules.

Sometimes, it is necessary to file violation cases against the disobedient, and there have been many convictions and fines imposed upon shippers and carriers.

During the last fiscal year there were issued more than 106,000 certificates. The following table shows in detail the year's business.

TABLE

	Certified	Infest.	B.T.	G.M.E.C.	Larvae, Pupae, etc.
Forest products	12807	115		895	106
Quarry products	60518	132		458	31
Nursery stock	31885	19	3	25	4
Evergreens	1014	5		6	
Permits issued	657				
	106881	271	3	1384	141

CHAIRMAN SASSCER: Mr. Rogers' paper is now open for discussion.

MR. GLENN: Did one inspector do all the work that was necessary, inspecting nursery stock at shipping time, etc., in the colored areas on the map?

MR. ROGERS: Except in an emergency. Of course, a great many of those sections have almost no nursery stock. There are no important nurseries in Maine, New Hampshire or Vermont.

MR. GLENN: Is it necessary to maintain inspectors at certain large nurseries all the time?

MR. ROGERS: Yes, we keep an inspector at the Burr & Co. nursery all the year around.

MR. GLENN: Is the same thing true with greenhouses?

MR. ROGERS: No, we don't inspect greenhouse products at all.

MR. E. N. CORY: Mr. Chairman, first I want to express my approval of the manner in which the Christmas tree proposition has been handled, and secondly I want to ask Mr. Rogers whether there seems to be a tendency on the part of the cutters to cut in areas that are known to be or are supposed to be free from egg cluster.

MR. ROGERS: Mr. Chairman, I might say that we haven't found an egg cluster on 2,000,000 Christmas trees examined. It is all infested area but the infestation is very light.

CHAIRMAN SASSCER: We will proceed to the fourth paper on the program.

PORT INSPECTION AND A FEW OF THE PROBLEMS WHICH ARE ENCOUNTERED

By L. A. STRONG

ABSTRACT

The constantly increasing amount of plant material passing through the ports of entry was commented upon, and the State inspectors were highly commended for the part they are taking in helping to inspect the nursery stock which can not be handled at the ports.

The urgent need for more men to properly carry on the work at the ports was stressed. Some of the ports are not adequately manned to handle the work efficiently and contraband material is known to slip by, while at other ports where the amount of material coming through is not large, we are not even able to place an inspector. The remedy for the situation was pointed out as being sufficient funds to maintain an adequate inspection force. The various phases of the work were well illustrated by lantern slides.

CHAIRMAN SASSCER: Are there any questions in connection with this paper?

DR. C. L. MARLATT: Mr. Chairman, I think the membership of this Section realizes that Mr. Strong has a full-sized job. The great need is the one that he pointed out: man-power. He made an estimate. It was approved by us for an increased appropriation of $193,620. The Secretary of Agriculture approved $100,000 of that. When it got through the Budget Committee it was reduced to $25,000 and when Congress got through with it it was reduced to about $18,000.

The big need in connection with the work at the present time is additional funds to enable us to properly conduct the work. It is encouraging, however, to note that funds are gradually being increased for this and other work.

It is interesting to know that the authorities in the Department realize the importance of this work. I think our Director of Regulatory Work,

whom we had hoped to have here this afternoon to say a few words to us, fully appreciates the importance of this work. In fact, he has told me repeatedly that he considered this the most important work that the Department of Agriculture is doing. It is rare that we find a man with such discernment. (Laughter and applause.)

CHAIRMAN SASSCER: We will proceed to the fifth paper, by Mr. Stockwell.

THE JAPANESE BEETLE QUARANTINE[1]

By C. W. STOCKWELL, *Administrative Officer*,
United States Department of Agriculture

The Japanese beetle, introduced into the United States some years ago, was first found by inspectors of the New Jersey Department of Agriculture near Riverton, N. J., in 1916. Its increase in numbers and dispersion during the following two summers indicated possibilities of its becoming of serious economic importance if allowed to spread to other and remote sections of this country.

In view of this fact, a Federal quarantine was made on June 1, 1919, effective on sweet corn alone, it being considered the most likely carrier of the adult beetles. Developments of that year, however, brought out the fact that other farm products, and greenhouse stock, soil, etc., were to be considered as carriers of either beetles or grubs, a Federal quarantine was therefore made, effective April 1, 1920, regulating the movement of farm produce, and the other carriers just mentioned. State quarantines, identical with the Federal quarantine, have also been in force in the infested States, restricting shipments within them. Since that time, a quarantine of this nature has been in force with changes from year to year to meet new conditions, and the area involved has grown from an infested area of 48 square miles in New Jersey in 1919 to one now of 5,122 square miles in New Jersey, Pennsylvania and Delaware.

Such a quarantine, regulating the movement of so extensive a list of products from an area so intensively populated as the territory around Philadelphia and including that city itself, presents a very difficult problem to handle. The estimated population of the 1,522 square miles of infested territory is in excess of three million. In this area are included thousands of farms, the products of a great number of which are grown for outside markets. In addition to the produce grown locally, large quantities of fruit and vegetables are shipped from remote sections of the country to Philadelphia for distribution. There are also hundreds of

[1] Contribution No. 8 from the Japanese Beetle Laboratory, Riverton, N. J.

commercial nurseries and greenhouses, a large number of which are affected; doing business within the regulated area; while others, having only a local trade, are not seriously concerned.

The nature of the articles covered divides this quarantine into two distinct phases, known as the Farm Products and the Nursery Quarantines.

The Farm Products Quarantine

Owing to the fact that farm produce is infested by the insect in the adult stage only, the restrictions on farm produce are effective only during the season of beetle activity, that is from June 15 to October 15. During this period the articles most likely to serve as carriers for adult beetles are either denied shipment from the quarantined zone or allowed shipment upon inspection and certification.

Shipments are divided into two classes: those from the point of production (i. e. the farm where grown), and those from the city of Philadelphia. Because of entirely different conditions, the restricted articles differ in these two classes.

Prohibited shipments from the point of production include a restricted list of vegetables, forage crops and cut flowers grown out of doors. Sweet corn is the largest carrier of beetles; during the past summer 138,000 bags of it were inspected, from which more than 68,000 beetles were removed. The infestation in other crops was comparatively very small. Smooth skinned fruits and vegetables are not likely to be carriers of beetles, although their containers might sometimes be considered such, if placed, when packed, in proximity to infested objects. Because of the intensive handling involved in grading and packing, graded fruits are probably the least likely of any to be infested.

Shipments from Philadelphia, however, fall into an entirely different class. The immense quantities of produce concentrated in the wholesale markets from widely separated points and from the most heavily infested areas in New Jersey and Pennsylvania make inspection and certification a difficult task. A much larger number of products are necessarily quarantined from this point, including boxed and crated fruits and vegetables from the West and South. Because of the congested conditions within the city and numerous other difficulties certain of the articles more difficult to inspect were denied shipment during the past season. Inspection platforms were erected at strategic points within the city for inspecting the products considered less likely to be infested and which could be handled with the minimum amount of labor and damage. In addition to this, hundreds of carloads of produce from points outside the

regulated area were certified for direct reshipment at the freight yards, either by rail or in sealed trucks.

In connection with the certification and inspection of produce within the quarantined area, a large corps of inspectors was maintained at the outside limits of the quarantined zone to stop all traffic and ascertain whether prohibited articles were being carried. On some of the most travelled highways inspectors were on duty 24 hours a day and in Pennsylvania the services of a considerable number of State police were used besides. All roads leading from the quarantined area were marked with warning signs, those upon the main highways being large and lighted with electric lights at night when inspectors were on duty. During the past summer there were about 325 men employed in connection with the Farm Products Quarantine.

The Nursery Quarantine

The Nursery Quarantine regulates the movement of all nursery, ornamental and greenhouse stock, sand, soil, earth, peat, compost and manure.

Nurseries and greenhouses are divided into three classes according to their location with respect to infestation. Those within the heavily and slightly infested areas are subject to rigid inspection and certification; the requirements are less strict for those within the outside safety zone. Stock grown within the actually infested territory must be shipped free from all soil, or, in the case of plants requiring soil about the roots, such as evergreens, they must be treated by methods worked out at the laboratory. These shipments are made under the supervision of an inspector of this Department who also supervises the digging of treated plants and inspects the soil about them. Certain perennials grown out of doors which can not be readily washed free of soil, are treated in vats containing chemicals which do not injure the plants but do kill the living larvae. Thousands of plants treated in this way have been inspected, and no living grubs found in them.

Greenhouse stock must all be potted in "soil free from grubs," made so by sterilization or fumigation. Plants grown outdoors during the summer must be washed free from soil before potting, or treated with an emulsion of carbon disulphide before they are moved into the greenhouses. Greenhouses within the infested area are kept tightly screened whenever beetles are active, to prevent their entrance and the infestation of the plants within. Some of the larger greenhouse concerns have gone to a great deal of expense in screening their houses and safeguarding them against infestation.

In connection with the nursery and greenhouse inspection, trained scouts are maintained throughout the summer to scout frequently the premises of nurseries and greenhouses not known to be infested, and also to see that screened greenhouses are kept closed.

The yearly spread of this insect, with the inclusion of new territory, adds greatly to the number of concerns and individuals affected in some way by the regulations. A much larger organization has to be built up for handling the actual inspection and certification work, as well as the investigation of innumerable new problems. Up to the present time no distant infestations in States, other than those already infested have been located and, provided that regulations similar to those now in force are continued, it is felt that the Japanese beetle may be held within reasonable bounds for some time to come.

CHAIRMAN SASSCER: This paper is now open for discussion.

MR. F. M. O'BYRNE: Mr. Chairman, I understand that last year the spread was considerable so that next year there will be a great many more nurseries in this severely infested area. I also have heard that the amount of money requested for the Japanese Beetle work was very severely cut; something like one-half of the amount requested. Are we to take this as an indication that the rigid requirements which have been placed on the nurseries in the past will be continued, or will there have to be a lightening of those requirements?

MR. STOCKWELL: At the present time it isn't known exactly how much money will be available, but the estimates provide for enough to take care of the nursery quarantine.

Also, the states have increased, or are trying to get money in excess of what they had last year to carry on both nursery and farm products quarantine.

DR. C. L. MARLATT: There is always an opportunity or possibility of getting additional money later on, in addition to that provided in the appropriation. That has happened nearly every year. We have been able to get extra money. My own feeling on this important matter is that they should go ahead and do the work they believe to be really necessary and essential to the prevention of excessive movement of pests, and if there isn't money available to carry that out for a full year, carry it out as far as they can go and let Congress know in due time and request additional money. In other words, I don't believe it is an economical expenditure in any quarantine work to do half a job; that is, to

do work which is largely wasted because it isn't adequate or complete enough to prevent movement. I would just as soon have fifty beetles move into new territory as ten. Ten beetles are going to carry the infestation just as surely as the fifty, and unless we can give some guaranty that the work is sufficient to prevent movement so far as is reasonably possible, we might as well save the money that we are now spending.

MR. L. B. SMITH: Just one word in regard to the question of the quarantine for another year. We are not anticipating any let-up in the restrictions whatsoever. Reports at the present time on Federal appropriations are under way; we don't know what they will be finally. Our organization is supported not only by Federal funds but also by funds contributed by the respective states with whom we are cooperating, but there is no reason to fear that our enforcement of the regulations is going to be any less than it is at the present time.

MR. F. M. O'BYRNE: I wonder if Mr. Smith or Dr. Marlatt could give us an estimate as to how much more it will cost to enforce the nursery regulations next year than it did last year.

MR. SMITH: The cost of the enforcement of the nursery regulations for next year is estimated at nearly three times the cost of this past year. That includes, of course, an increase in the scouting because the scouting work is conducted in connection with the enforcement of the nursery quarantine, but next year it will run, in round figures, about $150,000 for the nursery quarantine.

CHAIRMAN SASSCER: If there are no other questions we will proceed with the program and take up next the reports of committees.

MR. L. A. STRONG: Before doing so I move that the Chair appoint a committee of three or five, as he may deem necessary, to look into the possibility of securing additional time to be devoted to plant quarantine problems annually.

CHAIRMAN SASSCER: It has been moved and seconded that a committee of three or five be appointed to look into the desirability of increasing the time allotted to the annual discussion of plant quarantine problems. Is there any discussion of the motion?

DR. MONTGOMERY (Florida): I am not very sure that the idea which the Chairman had in mind when he offered the suggestion is being fully carried out in the motion as it is being put. I am inclined to think that the province of this Committee should be quite a little broader, and that it should include a report with recommendations as to the desirability and advisability of a complete and entire reorganization of our present activities.

I believe that if a plan was formulated which would permit of meetings to be held possibly in conjunction with the main association, possibly independently, we would reap great benefit from it, and I would offer an amendment to the motion to that effect in order to permit the Committee to broaden its scope and offer plans looking toward a complete reorganization.

CHAIRMAN SASSCER: You have heard the remarks of Dr. Montgomery which are in effect an amendment to the motion offered by Mr. Strong. Do you wish to discuss the proposal of Dr. Montgomery or carry out the original motion? My impression is that Mr. Strong's motion contemplated going as far as necessary to accomplish the results. I think also that this matter should be given very careful consideration because of our close affiliation with the Association of Economic Entomologists. Moreover, as our meetings only take place annually, while I did not so express myself earlier in the afternoon, I was in hopes that we could accomplish some results and get perhaps a little more time for next year, and at that time perhaps have a definite recommendation made back to the Section as to what we should do in the future. Certainly we can't ask for any more of the Association's time but we may be able to get a little time prior to the general meeting.

CHAIRMAN SASSCER: Dr. Montgomery has withdrawn his amendment, so we will consider the original motion. It was duly carried.

CHAIRMAN SASSCER: I will appoint on that Committee the following: Dr. Newell, Prof. Cory, Mr. McLaine, Mr. Strong and Mr. Glenn.

We will now take up the reports of committees.

DR. T. J. HEADLEE: This report will be a rather peculiar one in some respects and may or may not meet with your approval, but it represents the truth as the Committee sees it, and you are at perfect liberty to do what you please with it.

TO THE MEMBERS OF THE HORTICULTURAL INSPECTION SECTION OF THE AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

GENTLEMEN:

Through the medium of the JOURNAL OF ECONOMIC ENTOMOLOGY and the questionnaire recently sent to state and federal plant quarantine and inspection officials, most of you are doubtless familiar with the activities of your special committee on the unification of nursery stock inspection. The statement and questionnaire sent to you in early October, 1924, represented an honest effort to learn how you felt about taking the direct road to unification. Leaving all other points of the proposed plan aside, the crucial point was to see whether you favored a sufficient federalization of the inspection service to permit the formation of a strong control body with country-wide power to compel unification.

Twenty-two states out of forty-eight have responded to date. The response has come from well distributed states, covering all quarters of the country. The statements are overwhelmingly against the granting of this power. The committee, therefore, feels that it is at this time inadvisable to continue further consideration of this plan. At least, so far as state plant inspection officials are concerned, the country is not ready for this step. These conclusions are materially strengthened by the belief that any less federalization of authority would render a plan of this sort unacceptable to federal officials and would fail to secure the use of the U. S. certificate.

In view of the fact that the finding of the above conclusions concerning the direct method of unification does not appear completely to discharge the whole duty of your committee, your committee, recognizing that unification must probably take the longer route to its ultimate goal, will make some further proposals which are based upon three widely recognized needs of the inspection and quarantine services of the various states. These needs are: (1) Board of country-wide composition for reviewing and advising on proposed state quarantines affecting interstate business in nursery products; (2) regional, voluntary organizations for conference and agreement on plant quarantine and inspection matters; and (3) standardization to as practical an extent as may be possible of nursery stock requirements and inspection practice.

The proposals which follow must be taken merely as suggestions as to possible procedure.

Your committee suggests that continental United States be divided into four regional groups of states: (1) The western group consisting of the row beginning with Montana and ending with New Mexico, and thence westward to the Pacific Ocean (Such an organization of the states included in this area, but also including Lower California, Hawaii, and British Columbia, has been functioning for the past six years); (2) a southern group consisting of the Gulf states, Oklahoma, Arkansas, Tennessee, Georgia, and the Carolinas; (3) a midwestern group consisting of Kansas, Missouri, Kentucky, and thence northward to the Canadian Border; and (4) the middle Atlantic and northeastern group consisting of Virginia, West Virginia, and thence northward to the Canadian Border.

Your committee suggests that each group form a definite organization by adopting a constitution and by-laws, by electing officers, and by holding a regular meeting each year.

Your committee further suggests that a country-wide board of review be formed of two members from each group of states and two members representing the Federal Horticultural Board. It suggests that each group of states elect its two members, one for two years and the other for three years, and thereafter that the term should be three years. The committee suggests that the Federal Horticultural Board designate its representatives on the basis of the same length of terms.

Your committee suggests that the problem of standardization of nursery inspection and quarantine practice be attacked by this board of review.

Your committee suggests that the chairman of the present session of this section appoint a special committee of three plant inspection and quarantine workers for each of the proposed groups, except the western, whose duty it shall be to do and perform that which is necessary to a formation of the proper organization.

T. J. HEADLEE,
Chairman

CHAIRMAN SASSCER: You have heard the report of Dr. Headlee; what is the pleasure of the Section?

MR. E. N. CORY: I move we accept this report, Mr. Chairman.

The motion was regularly seconded and carried.

CHAIRMAN SASSCER: In accepting this report I presume it is your intention that the Chairman is to appoint the committees provided for.

DR. J. H. MONTGOMERY: Mr. Chairman, I move that the Committee be discharged with the thanks of the Section.

The motion was regularly seconded and carried.

CHAIRMAN SASSCER: If there is no further discussion in regard to the report of this Committee we will now hear from the Committee on Nominations, Professor Cory.

MR. E. N. CORY: Mr. Chairman, it gives me pleasure to report for the Committee on Nominations that we present the names of C. H. Hadley for Chairman and Mr. W. B. Wood, the present incumbent, as Secretary.

CHAIRMAN SASSCER: You have heard the report of the Nominating Committee, the nominations being Mr. C. H. Hadley for Chairman and Mr. W. B. Wood for Secretary. What is your pleasure?

DR. T. J. HEADLEE: I move the adoption of the recommendation of the Committee, and that the Secretary cast the ballot for the election of the officers nominated.

The motion was regularly seconded.

CHAIRMAN SASSCER: You have heard Dr. Headlee's motion which has been seconded. Those in favor say "aye;" opposed, "no." The "ayes" have it and Mr. Hadley is duly elected Chairman of the Section of Horticultural Inspection for the ensuing year and Mr. W. B. Wood will continue as Secretary.

The meeting adjourned at 4:15 P. M.

THIRD ANNUAL ROCKY MOUNTAIN CONFERENCE OF ENTOMOLOGISTS

The conference will be held in Pingree Park, Colorado, August 17 to 22 this year. You cannot afford to miss this informal gathering of entomologists and their families in their outing clothes and rustic manners in the mountains for a happy combination of play and work.

Everyone will be expected to tell something of his work, plans and the things he thinks should be done for the betterment of our profession.

If as many come as attended last year, it will be necessary for some to sleep in tents. Transportation can be arranged for all to and from the Park at a very reasonable price, but, if you can, bring your "tin Lizzie;" also bring a tent or bedding; let us know just what you will bring so we can arrange for what will be needed.

If you think you can come, let us know at as early a date as possible and also let us know how many will accompany you. Also, let us know what topic you will discuss and suggest any that you would like to have considered at the meeting.

C. P. GILLETTE, *Chairman*
GEO. M. LIST, *Secretary*

REMARKS ON THE NUMBER OF GENERATIONS OF THE EUROPEAN CORN BORER IN AMERICA

By GEO. W. BARBER, *Cereal and Forage Insect Investigations, Bureau of Entomology, U. S. Department of Agriculture*

ABSTRACT

In this paper the theory that there are at present two geographical races of the European corn borer, *Pyrausta nubilalis*, in America is discussed. Larvae transferred from New York to Massachusetts in 1920 have for four years maintained a single annual generation while larvae from Massachusetts that had a single generation during 1920 have been reared under the same conditions and have had a partial second generation each year. The fact that individuals in the infested area about Lake Erie are practically all large and well nourished while in New England many larvae enter hibernation in the fall half starved and from a third to a half smaller than normal larvae suggests the theory that the infestation about Lake Erie will be more dependable from year to year. This has proved to be the case during 1923 and 1924 when the New England infestation has decreased and the infestation about Lake Erie has increased both as to spread and in intensity of infestation. There is also considered the theory that the New England infestation may be reverting to a single generation habit by a process of natural selection in view of an environment that will not support two annual generations.

Since the discovery of the European corn borer in the territory about Lake Erie and the recognition that there the insect has a single generation annually while in the infested area in New England two generations occur each year, speculation has existed as to the cause of this phenomenon. Theories have been advanced as to the possible cause of the difference in number of generations between the two areas now infested but the actual solution of the problem is rather elusive, so much so that even at the present time the matter is still an open question.

This subject has received considerable attention from those engaged in research work on this insect and several possible explanations have been offered, the most important of these being: 1, that the difference in number of generations of the corn borer between New England and the area about Lake Erie is to be explained by response to environmental factors or in difference in climatic conditions between these two areas; 2, that the difference in number of generations is to be explained by the existence of two distinct geographical races, a two generation one in New England and a single generation one in the infested area about Lake Erie. The first of these subjects was treated of by my colleague, Mr. K. W. Babcock, in Vol. 17; p. 120 of this journal. It is the second of these subjects that the writer wishes to discuss at the present time.

In the infested area about Lake Erie the flight of moths occurs during the last week in June and the first three weeks in July, the resulting progeny becoming full grown from the middle to the last of August, and

remaining to pass the winter. Of the many thousands of individuals that have been examined by scores of observers in this area during the six years that this infestation has been under observation, only an occasional pupa of a second generation has been found in the field. The insect, then, has one generation in this area each year and it is worthy of remark that practically all of the individuals are large, well nourished insects indicative of an abundant food supply and of a season of ample length to allow all individuals to attain full size.

In New England the first flight of moths begins during the last week of May and extends through the month of June, the resulting progeny becoming full grown by the last of July or early August, pupating and giving rise to a second flight of adults during the month of August. Usually the mid-season pupation is not complete, however, a certain per cent of individuals remaining in the host plant as larvae to pass the winter as single generation individuals of that year. During the past five years the per cent of these one generation individuals has been as follows:

1920—30 per cent of one generation individuals
1921—None
1922—14 per cent " " " "
1923—40 per cent " " " "
1924—22 per cent " " " "

Progeny of individual adults, indeed of single egg masses, have been found to consist of both one and two generation individuals as shown in the following table from rearing experiments of 1920.

Item	Larvae died, killed, or lost	Pupated; two generation individuals	Did not pupate; one generation individuals	Parent
1	13	4	3	from 1 female adult
2	10	1	3	" 1 " "
3	1	2	1	" 1 " " (single egg mass)
4	16	3	5	" 1 " "
5	3	1	2	" 1 " "
6	68	17	8	" 1 " "

During 1923 considerable information was obtained on the variation of the per cent of one generation individuals in different locations and in corn of different plantings. The per cent of one generation individuals in sweet corn of different plantings was found to be:

In very early sweet corn	(6 localities)	15.7 per cent
In mid-season sweet corn	(6 localities)	54 per cent

Proximity to the sea appeared to have a retarding effect on development as shown in the following records:

Towns bordering the sea (To 5 miles inland	(18 localities)	43 per cent one generation
Towns somewhat removed from the sea (5 to 10 miles inland)	(12 localities)	39.3 per cent " "
Towns considerably removed from the sea (10 to 25 miles inland)	(6 localities)	29.5 per cent " "

In 42 examinations in 39 different towns during 1923 the average per cent of one generation individuals was:

Number of localities with less than 10 per cent of one generation individuals	2
" " " " from 10 to 20% of one generation individuals	5
" " " " " 20 to 30% " " " "	6
" " " " " 30 to 40% " " " "	9
" " " " " 40 to 50% " " " "	7
" " " " more than 50% " " " "	13

No constant differences in the per cent of one generation individuals were found between northern points and localities in the southern part of the infested area or between low and high land. The per cent of one generation habit was most closely and constantly associated with the development of the food plant.

Although the main flight of the mid-season generation of moths in New England is during the month of August, scattered individuals continue to pupate and emerge during September so that the condition of larvae entering hibernation in the fall is, first, full grown, well nourished, one generation individuals; second, full grown individuals of the second generation; and, third, smaller larvae of the second generation, especially the progeny of the late emerging moths, which although in the proper instar have failed to attain full size by the time cold weather arrives and present a decided undernourished appearance. These half starved larvae are able to survive the winter, however, and result in moths from a third to a half smaller than normal individuals. The spring flight of moths in New England, therefore, is comprised of many adults equal in size to the adults in the western area, but it also contains large numbers of smaller individuals grading down to some only half as large as the normal adult from New York or Ohio. In fact lots of adults from the two infestations may be separated readily by the variation in size alone.

It may be that in New England this insect is now undergoing a process of natural selection that will eventually lead to a one generation habit similar to that in the western infestation. This may result because those individuals that are content with one generation annually will be more successful in reproducing abundant offspring of high vigor than the two generation individuals, particularly those that are undernourished and

less vigorous. In support of this theory it was noticed that during 1924 several small female adults (that is, individuals a third to a half smaller than the normal adult) laid few eggs or no eggs at all. If such a condition continued over a period of years, with large numbers of small adults of low vigor, a gradual extermination of the two generation individuals and a gradual reversion to a one generation habit might quite readily result. This condition has been particularly noticeable during 1924 in New England, where notwithstanding that very mild weather continued up to the middle of November, a larger proportion of undersized larvae were found than ever before. The first evidence of one generation individuals in New England was obtained in rearing experiments of 1920, and subsequent observations in the field showed that such a condition also existed under natural conditions that year. No evidence of one generation individuals had been found during 1918[1] and 1919 although many larvae were reared in the insectary. Although no evidence of one generation individuals was obtained in 1921, during 1922, 1923, and 1924 they were quite noticeable as shown in the table previously noticed. It may be, therefore, that the process of natural selection or reversion is even now at work in New England, and that the first steps are being taken towards an eventual one generation habit in this area.

Of the two infestations, that in the territory about Lake Erie seems in some respects to be the more vigorous. Within the last five years it has spread much more rapidly than in New England, and it seems to withstand unfavorable weather conditions more easily than the New England stock which during the last two years has greatly decreased in numbers. To be sure no examples of such extensive massing of larvae have so far been observed in the western area as have occurred in New England, but this may be explained in the more open, level agricultural country that is found there, as contrasted to New England's wooded areas that serve to some extent as natural barriers, and at the same time indicate a much more limited abundance of food plants, so that individuals become concentrated in favorable localities.

In the fall of 1920 a lot of larvae was transferred from the infested area in New York where the insect was found to have had one generation to Medford, Mass. where two generations were found each year and placed in a field cage. In a second cage were placed larvae from New England that had during that year a single generation, or progeny of the spring flight of moths. These cages have been carried up to the

[1]Vinal and Caffrey 1919 Mass. Agri. Exp. Station Bull. 189.

present time with this original material, the flight of moths being observed each year, but the insects being disturbed as little as possible.

It is notable that for four years the flight of moths in the cage containing New York material has very closely coincided with the flight of moths in the field in the western area while the flight of moths in the cage containing New England material has closely followed the flight of moths in the field in New England. Furthermore, although the New England material introduced in the check cage was of individuals that had one generation during 1920, a second flight of moths has been observed in this cage each of the four years, indicative of at least a partial second generation each year, while in no instance has a second flight of moths appeared in the cage containing New York material. For four years the New York individuals have held to the seasonal history noticed in the area of their origin, and seemingly have not been influenced enough by the climatic conditions of the new locality noticeably to effect their seasonal history.

From these results the question is naturally raised whether we are not, in fact, dealing with two more or less distinct geographical races of this insect. Literature is particularly meagre in comparable cases, but there may be mentioned the case of univoltine, bivoltine, and polyvoltine races of the silk worm. A somewhat comparable example also exists in the case of the periodical cicada which has a 17 year race and a 13 year race, the former in distribution mainly northern while the latter is mainly southern in extent but as Marlatt (1907 U. S. Dept. Agri., Bureau of Ent., Bull. N. S. 71, p. 28) has shown, there is an overlapping of these two races over large areas which is not to be explained by purely environmental conditions.

The opinion now seems to be that in the case of the European corn borer there has been more than a single introduction of the insect into this country, and it may well be that the source of the material introduced into New England was not the same as that which was introduced to give rise to the western infestation. This would permit the theory that the material introduced into New England came from a section of Europe where the insect had two generations while the material introduced into the area about Lake Erie came from a section of Europe where the insect had one generation.

In its original habitat it is probable that this insect was either of one generation or more than one generation developed annually. If of a single generation the spread of the species into warmer sections may have, through reason of a warmer climate, caused the species to assume

a second generation annually. But this condition may not have been produced at once, on the contrary a second generation may have resulted only after many years in the new environment. If this were the case, many years might pass before the two generation race would revert to the one generation condition in view of an environment that would not warrant two annual generations or conversely.

There is some reason to believe that the material in the western area will be the more successful in spreading and becoming generally injurious, while the stock in New England, although becoming very plentiful at times, dissipates the general vitality to some extent by its urge for a second generation which often results, as previously mentioned, in weak, half-starved individuals. It is interesting to note that in 1921 two complete generations occurred in New England, the overwintering larvae being for the most part full grown and well nourished. This was possible because of an extremely favorable season. The result of this condition was that during 1922 the heaviest infestation yet known in this area occurred. But great numbers of larvae of the second generation of that year entered hibernation as small undernourished individuals, due in part to an overpopulation in some areas, and in part to the lack of time to reach full size before feeding was discontinued, because of cold weather. Nineteen twenty-three and 1924 have witnessed a great decline in the abundance of this insect in New England, the reason being found in several contributing factors, of which the weak condition of many larvae entering hibernation in the falls of 1922 and 1923, may well be one. On the other hand during the same period that has witnessed a decline in the New England infestation—1923 and 1924—a very substantial increase in severity and extent of infestation has appeared in the western area.

In some respects, therefore, it seems as though the urge of the New England individuals to complete two generations each season results in their own undoing, while the conduct of the individuals in the western area in being content with one annual generation results in such healthy, vigorous, individuals that a more dependable infestation is produced.

A further condition that seems to support the theory that two races of this insect are present in North America is found in the food plant habits. Up to the present time the European corn borer in Eastern New England has been found to be a very general feeder in succulent vegetation and while corn seems to be the preferred food plant, several other species—Dahlia, cocklebur (*Xanthium* spp.), barnyard grass (*Echinochloa crusgalli* (L) Beauv.), and dock (*Rumex* spp.)—are accepted with

almost if not quite the relish with which the insect attacks corn. On the other hand, the European corn borer in the area about Lake Erie has been found to be almost entirely confined to corn. This condition may be due in part to the differences in larval population that have been found in the two areas thus far—concentrated populations in New England and more scattered populations in the area about Lake Erie—the availability of corn which is grown abundantly in large fields in the Lake Erie region and less abundantly in smaller fields in New England, and the existence of many natural barriers to dispersion, such as wooded areas, in New England, that are of less importance in the Lake Erie region. But even in the more sparsely infested sections of New England where plenty of corn is available for food of the limited number of larvae present, and in years of reduced population of the insect such as 1923 and 1924, when competition for food was unknown, it was found that larvae commonly attacked plants other than corn.

In America what may perhaps be two geographical races of this insect are still clearly defined and separated by a strip of uninfested territory; the urge of the one is to complete one generation annually, while the other endeavors to squeeze two generations into a season in which it has varying success. These two infestations are now separated by some fifty miles; each, so far as our knowledge goes, still maintaining its urge of one or two generation habit, but this distance is being rapidly shortened so that in a very few years they may be expected to meet and overlap. A highly interesting condition will then be found that may finally enable the correct interpretation of this subject. Equally interesting will be the result of the natural crossing of these two races in the field, and the possible spread of the resulting progeny westward.

A COLORIMETRIC METHOD FOR SHOWING THE DISTRIBUTION AND QUANTITY OF LEAD ARSENATE UPON SPRAYED AND DUSTED SURFACES[1]

By C. C. HAMILTON, *Associate Entomologist, University of Maryland* and C. M. SMITH, *Chemist, Bureau of Chemistry, Washington, D. C.*

ABSTRACT

The methods for showing the distribution and quantity of lead arsenate, as presented in this paper, were developed to meet the needs of the senior author in a study of spreaders. The usual methods of determining the distribution of lead arsenate were inadequate, and a method shorter and easier than the standard Gutzeit method

[1]Contribution from the Entomological Laboratory, of the University of Maryland, embodying some of the results obtained in Project No. 23, part II, and the Insecticide and Fungicide Laboratory, Miscellaneous Division, Bureau of Chemistry.

of arsenic determination was needed for showing the quantity of lead arsenate upon sprayed surfaces. Several ways for indicating the distribution of lead arsenate were tried, such as photographs, x-ray photographs, microscopical examinations, etc., but none proved satisfactory except the "printing out" chemical method here described. The method for determining the quantity of lead arsenate was developed from this. Repeated tests have shown that, with careful manipulations, the methods described are accurate and that the probable error is less than variations due to differences in spraying. The manipulations are easily and rapidly made and do not require much or costly apparatus. The chemistry of the method is credited to the junior author and the working out of the details of the manipulation to the senior author.

Chemical Considerations

The methods which we have developed are based upon several well-known facts in the chemistry of lead. Most lead salts, including lead arsenate, are readily soluble in sodium hydroxide solution. The dissolved lead in such a solution, whether actually in the colloidal state or not, is readily adsorbed by certain materials, of which bibulous paper is one. When the sprayed surface is pressed upon blotting paper which has previously been saturated with a solution of sodium hydroxide, the hydroxide dissolves the lead arsenate. The lead is then adsorbed by the paper, no spreading occurs, and the resultant print reproduces even the structural details of the leaf. The lead, of course, is invisible at this stage, but exposure to hydrogen sulfide gas transforms it into a visible form, lead sulfide. Lead sulfide is ordinarily black, but in the thin films obtained by this process it shows colors ranging from yellow, through amber, to brown and rarely black, depending upon the quantity of lead present. Thus we obtain detailed visual evidence of where the lead is and, roughly how much of it there is—in other words, the quantitative distribution. When it is desired to estimate more accurately the total quantity of lead arsenate present, it may be dissolved from the leaf by sodium hydroxide and the solution treated with hydrogen sulfide, gum arabic being used to prevent coagulation and precipitation. The colors developed are similar to those obtained by the printing process and can be estimated by comparison with prepared standards.

Method of Showing the Distribution of Lead Arsenate

The following process is used in making the lead sulfide prints. White blotting paper is dipped into a two per cent solution of sodium hydroxide and the excess solution is drained off. Sprayed leaves, or any other sprayed objects, are placed upon the blotting paper, and, if both surfaces were sprayed, a similar piece of blotting paper is placed on top. The whole is then placed between several thicknesses of herbarium paper and pressed in a letter press for about thirty seconds. The sodium hy-

droxide dissolves the lead arsenate, which is then adsorbed by the blotting paper. The blotting paper is next exposed to hydrogen sulfide gas. A brown precipitate of lead sulfide is formed, which shows the distribution of the lead arsenate as it occurred upon the sprayed surface. After the lead sulfide print is developed the blotting paper is placed in running water and washed for 15 to 20 minutes to remove the sodium hydroxide, then passed through a wringer, pressed to remove the water, and dried rapidly in moving air. Rapid and thorough drying is essential to prevent oxidation and fading of the lead sulfide.

Several kinds of paper were tested to determine the kind best suited for use in making the prints. A good grade of filter paper will give an excellent print, but when wet with sodium hydroxide it is difficult to handle and will not stand washing. Glazed paper or paper containing a starch body will not adsorb the sodium hydroxide readily and discolors, and when pressed the lead spreads badly. White blotting paper of 100 pounds weight is easy to handle when wet, has body enough to hold sufficient sodium hydroxide to adsorb practically all the lead arsenate, and will stand washing. The blotting paper dries flat and is convenient to handle after drying, and any notes or records may be written upon it before dipping into the sodium hydroxide solution.

A two per cent solution of sodium hydroxide is sufficiently strong. Stronger solutions tend to destroy the fiber of the paper, and unless washed out the prints discolor, fade, and dry very slowly. The blotting paper may be handled easily by leaving one end dry and manipulating the other end with a spatula.

If the blotting paper is too moist, or the herbarium paper has adsorbed too much sodium hydroxide from the prints, or the pressure is too rapid and heavy, the sodium hydroxide may be squeezed out, carrying the dissolved lead with it and giving an inaccurate record of its distribution. On the other hand, with rather dry blotting paper or large quantities of lead arsenate not all of the lead arsenate is dissolved. The adsorption of the lead by the blotting paper is very rapid, and pressing from fifteen to thirty seconds gives as satisfactory results as pressing for a longer time.

The paper should be exposed to the hydrogen sulfide gas for only a few seconds. The lead sulfide forms very rapidly, and longer exposure may cause discoloration. All papers tested, except a few grades of filter paper, when dipped into the sodium hydroxide solution and exposed to the hydrogen sulfide gas for a longer time than was necessary, turned a

greenish blue, discoloring badly. This may be due to the presence of iron, the sulfide of which in small quantities is greenish.

Unwashed prints are likely to discolor and fade badly. The rinsing does not wash off the lead sulfide print, but it does prevent the extensive development of the blue color. Fifteen to twenty minutes in slowly running water is sufficient to remove most of the sodium hydroxide. Longer washing, however, will not damage the prints.

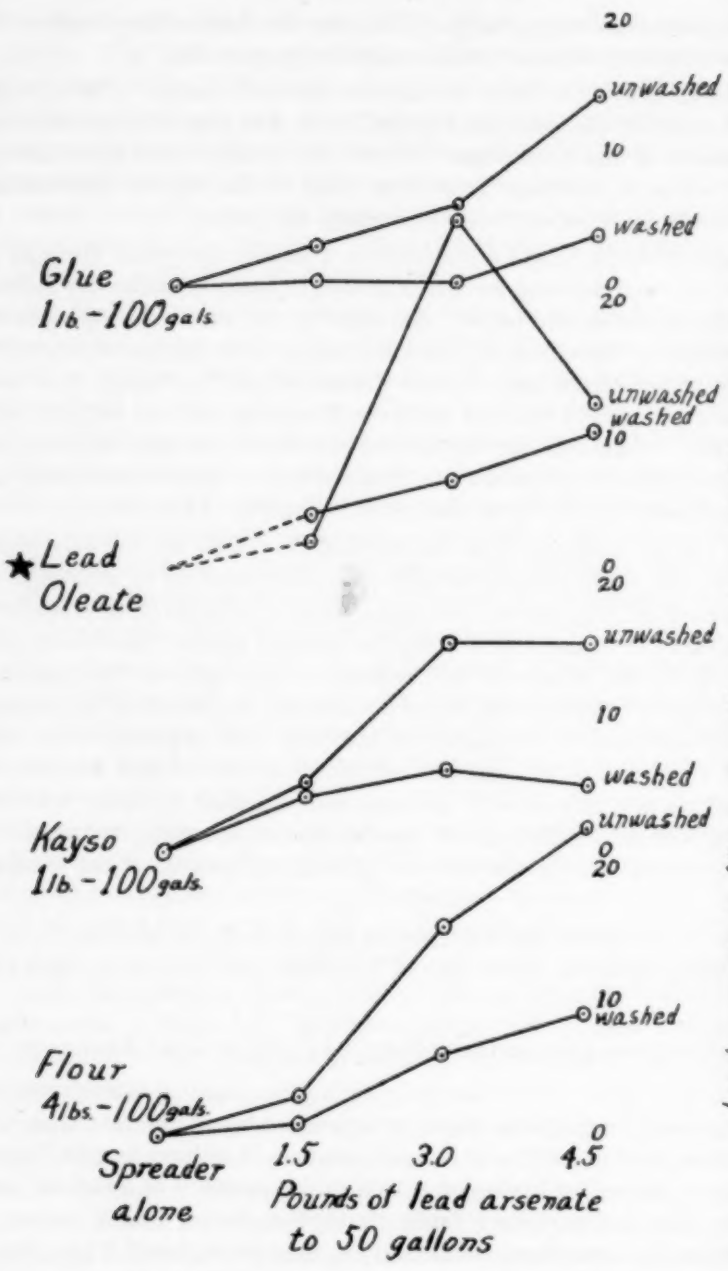
The excess water may be removed by running the prints through a wringer and then pressing for ten or fifteen minutes between dry sheets of blotting or herbarium paper. Exposure to the sun or drying by heat causes fading or discoloration; the most satisfactory method of drying is exposure to an electric fan. Unless the prints are thoroughly dried before being put away, the lead sulfide will oxidize and the imprint will disappear. To exclude the air and moisture and prevent oxidation of the lead sulfide, the prints may be brushed with a solution consisting of paraffine dissolved in four or five times its weight of benzene.

With careful manipulations the method described will remove practically all the lead arsenate when it has been used up to strengths of three pounds to fifty gallons. At strengths greater than three pounds to fifty gallons the quantity left upon the sprayed surface becomes appreciable. With six pounds of lead arsenate to fifty gallons the quantity not removed by the blotting paper and sodium hydroxide is equivalent to the whole quantity deposited by spraying with approximately one-half to one pound to fifty gallons. As three pounds of lead arsenate to fifty gallons is a considerably stronger mixture than is usually used for spraying, the lead sulfide prints should give an accurate record of the quantity as well as the distribution of lead arsenate upon the sprayed surface.

Plate No. 4 shows the distribution and quantity of lead arsenate on peach leaves sprayed at the rate of 1.5, 3 and 4.5 pounds per fifty gallons.

Method for Determining the Quantity of Lead Arsenate

The colorimetric method for determining the quantity of lead arsenate upon sprayed or dusted surfaces is dependent upon the fact that lead arsenate is readily soluble in a weak solution of sodium hydroxide and when precipitated by hydrogen sulfide in the presence of a colloid, such as gum arabic, forms very finely divided particles, which remain in suspension for some time, particularly in dilute solutions. This permits of comparison with standards made in a similar manner.



★The spreader was not available as such, hence no zero reading was obtained

Fig. 11.—Graph showing results from various applications.

All sodium hydroxide solutions used in dissolving the lead arsenate from sprayed surfaces and in diluting were of one per cent strength and contained one gram of gum arabic to 1000 cc.

The color standards are prepared by dissolving 1000 milligrams of lead arsenate[2] in 1000 cc. of sodium hydroxide and gum arabic solution. Solutions containing 0.01, 0.02, 0.03 etc. to 0.1 milligram of lead arsenate in each ten cc. are then made from this stock solution. About 50 cc. of each solution is made, and after precipitating the lead with hydrogen sulfide gas a portion of each solution is put in a Nessler tube or a test tube, all tubes used being of uniform size. Care should be taken to see that the liquid is the same depth in each tube. Under these conditions comparisons may be made either through the side of the tube or lengthwise, the latter giving more accurate results. Dilution of the unknown solutions, after the lead sulfide has been precipitated, may be necessary before making the readings.

In determining the average density of distribution of lead arsenate upon a sprayed surface, the area of the surface should first be determined. If the surface is irregular, a planimeter should be used. The sprayed object is then placed in a flat dish and covered with sodium hydroxide and gum arabic solution, the number of cc. used being equal to, or some small integral multiple of, the number of square inches in the area. Enough solution to wet thoroughly the sprayed object and dissolve the lead arsenate should be used. The lead arsenate goes into solution within one-half to one minute. Some chlorophyll may be extracted from sprayed leaves if they are left in the sodium hydroxide too long. After rocking back and forth to wash the sprayed object thoroughly and mix the solution, the solution is drained into a beaker or other vessel and the lead is precipitated with hydrogen sulfide gas. If necessary for convenience and accuracy of reading, a measured portion of the liquid is diluted an integral number of times until the color comes within the range of those in the standard tubes. The concentration of lead arsenate in the diluted unknown solution is then determined by comparison with the standards. The reading will be in milligrams of lead arsenate per 10 cc. Multiplying this reading by the number of cc. of sodium hydroxide used per square inch for dissolving the lead arsenate and by the number of times the unknown was diluted gives the quantity of lead arsenate for each 10 square inches of sprayed surface. Care should be used in making the dilutions and taking the readings, as a

[2]It is understood, of course, that there is more than one form of lead arsenate, and that since these contain different quantities of lead the standards should be made with the same arsenate as is used in the spraying experiments.

small error will be greatly increased when it is multiplied by the number of times the unknown was diluted.

Although the lead sulfide does not settle out rapidly, the suspension looks murky after standing for four or five hours, and lacks the clear color of suspensions containing freshly precipitated lead sulfide. Therefore, fresh standards should be made up for each day's work.

Table No. I gives the analyses of the lead arsenate upon peach leaves sprayed at the same time and with the same materials as those shown in plate No. 4. The results are also graphically shown in figure 11.

The method for showing the distribution and quantity of lead arsenate may be adapted to field work by substituting sodium sulfide dissolved in sodium hydroxide for the hydrogen sulfide gas. To make the lead sulfide prints, proceed as directed until ready to expose to the hydrogen sulfide gas. At this point dip the blotting paper into a one per cent solution of sodium hydroxide containing one per cent of sodium sulfide dissolved in it. This precipitates the lead sulfide, showing the distribution of the lead arsenate. In the field work for demonstration purposes it will not be necessary to wash and dry the prints unless it is desired to keep them.

To determine the quantity of lead arsenate, a few drops of saturated solution of sodium sulfide in a 10 per cent solution of sodium hydroxide may be used in place of the hydrogen sulfide gas.

EXPLANATION FOR PLATE NO. 4

Lead Sulfide prints of peach leaves sprayed with lead arsenate and various spreaders. All leaves were sprayed until they were thoroughly wet and spray material drained off. The outline of leaves 1, 5 and 12 have been drawn in with pencil.

1. Flour, 4 pounds to 100 gallons. No lead arsenate.
2. Flour, 4 pounds to 100 gallons. Lead arsenate 1.5 pounds to 50 gallons.
3. Flour, 4 pounds to 100 gallons. Lead arsenate 3.0 pounds to 50 gallons.
4. Flour, 4 pounds to 100 gallons. Lead arsenate 4.5 pounds to 50 gallons.
5. Kayso, 1 pound to 100 gallons. No lead arsenate.
6. Kayso, 1 pound to 100 gallons. Lead arsenate, 1.5 pounds to 50 gallons.
7. Kayso, 1 pound to 100 gallons. Lead arsenate 3.0 pounds to 50 gallons.
8. Kayso, 1 pound to 100 gallons. Lead arsenate 4.5 pounds to 50 gallons.
9. Lead oleate coated lead arsenate, 3 pounds to 50 gallons (paste).
10. Lead oleate coated lead arsenate, 6 pounds to 50 gallons (paste).
11. Lead oleate coated lead arsenate, 9 pounds to 50 gallons (paste).
12. Glue, 1 pound to 100 gallons. No lead arsenate.
13. Glue, 1 pound to 100 gallons. Lead arsenate 1.5 pounds to 50 gallons.
14. Glue, 1 pound to 100 gallons. Lead arsenate 3.0 pounds to 50 gallons.
15. Glue, 1 pound to 100 gallons. Lead arsenate 4.5 pounds to 50 gallons.

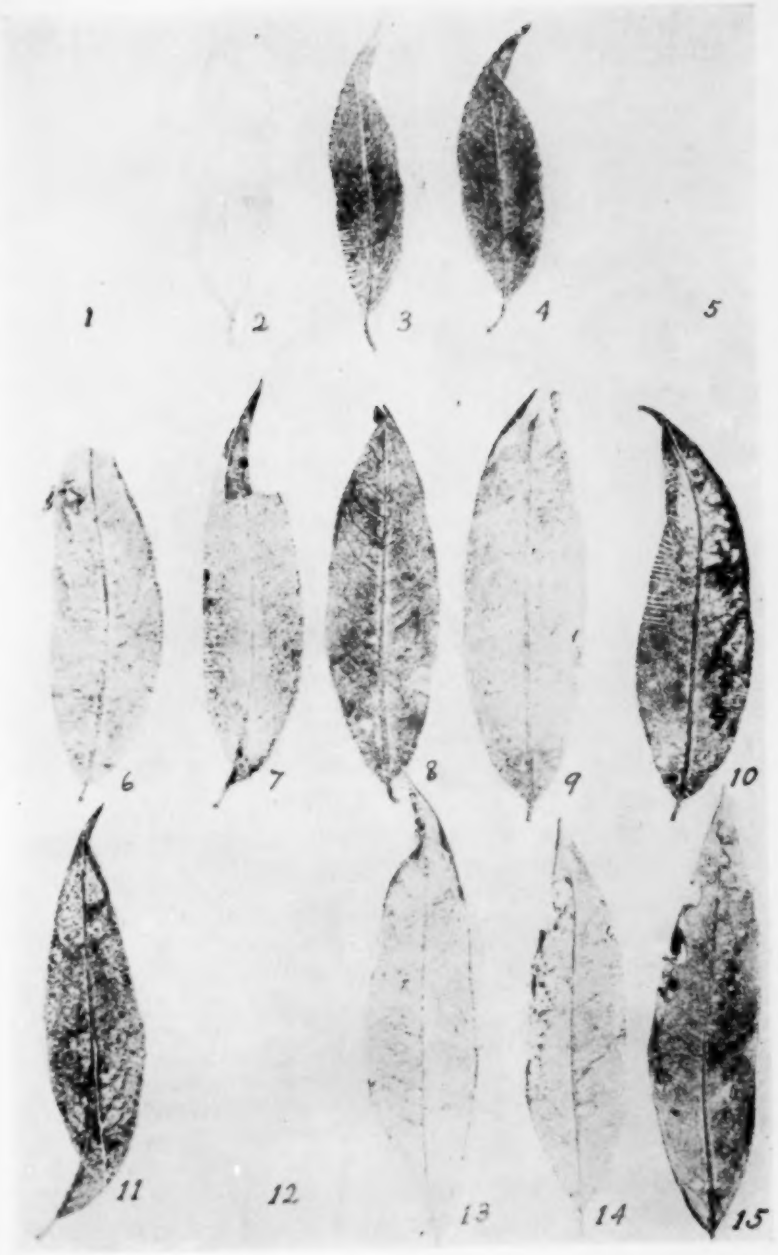

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TABLE NO. I. ANALYSES SHOWING THE AMOUNT OF LEAD ARSENATE IN MILLIGRAMS PER 10 SQUARE INCHES UPON SPRAYED PEACH LEAVES BEFORE AND AFTER WASHING

Lot No. and kind of spray material	Before Washing					After Washing				
	Area of both surfaces	No. cc. NaOH used	Dilution when read	Reading in mgms. to 10 cc.	Mgms. lead arseenate to 10 sq. in.	Area both surfaces	No. cc. NaOH used	Dilution when read	Reading in mgms. to 10 cc.	Mgms. lead arsenate to 10 sq. in.
1. Flour 4 lbs. to 100 gals. No lead arsenate	40.0	80.0	1	.00	.0	30.0	60.0	2	.00	.00
2. Flour 4 to 100 plus lead arsenate 1.5 to 50	41.6	83.0	10	.03	.3	38.0	76.0	2	.06	.12
3. Flour 4–100 plus lead arsenate 3.0 to 50	43.2	86.0	50	.03	1.5	37.2	74.5	10	.06	.60
4. Flour 4–100 plus lead arsenate 4.5–50	42.2	84.5	50	.045	2.25	39.4	79.0	10	.09	.90
5. Kayso 1 lb. to 100 gals. No lead arsenate	40.8	81.5	2	.00	.0	39.0	78.0	2	.00	.00
6. Kayso 1–100 plus lead arsenate 1.5 to 50	35.2	70.0	10	.05	.50	40.2	80.5	10	.04	.40
7. Kayso 1–100 plus lead arsenate 3.0–50	40.6	81.0	50	.03	1.50	46.2	92.5	10	.06	.60
8. Kayso 1–100 plus lead arsenate 4.5 to 50	42.4	85.0	50	.03	1.50	45.2	90.5	10	.05	.50
* 9. Lead oleate coated lead arsenate 3 to 50	48.6	48.5	5	.045	.22	44.0	88.0	10	.04	.40
*10. Lead oleate coated lead arsenate 6 to 50	41.4	83.0	50	.05	2.50	48.2	96.5	10	.065	.65
*11. Lead oleate coated lead arsenate 9–50	45.2	90.0	20	.06	1.20	45.2	90.5	20	.05	1.00
12. Glue 1 lb. to 100 gal. No lead arsenate	32.4	65.0	2	.00	.00	37.6	75.0	2	.00	.00
13. Glue 1–100 plus lead arsenate 1.5 to 50	42.6	85.0	10	.03	.30	44.6	89.0	2	.02	.04
14. Glue 1–100 plus lead arsenate 3.0–50	30.8	61.5	10	.06	.60	35.4	71.0	2	.04	.08
15. Glue 1–100 plus lead arsenate 4.5–50	37.2	74.5	20	.07	1.40	33.8	67.5	10	.04	.40

*This material was available only in the form of a paste containing approximately 50% water, and so the weight used was twice that of the other products.

THE RELATION OF INSECTS TO THE TRANSMISSION OF RASPBERRY LEAF CURL[1]

By FLOYD T. SMITH, *Bureau Plant Industry, Harrisburg, Penna.*

ABSTRACT

1. *Aphis rubiphila* Patch was the only insect carrier of raspberry leaf curl among several insects used.
2. The aphids must feed upon a diseased plant before becoming a carrier.
3. The infective agent is not carried over winter within the egg from the fall generation to the spring forms.
4. The infective agent is not inherited by the offspring in viviparous reproduction.
5. Leaf curl was transmitted from black to red raspberries but not from red to black varieties.

The first plant disease of the mosaic type shown to be transmitted by insects was "curly-top" of sugar beets. Shaw (6), in 1910, proved experimentally that *Euttetix tenella* Baker was the only common carrier.

[1]This paper is a resumé of part of the thesis presented toward the requirements for a Master's degree at Ohio State University.

Since that time a great deal of detailed work has been done with the relationships of this leaf-hopper to the curly top. Among other things Stahl and Carsner (7) showed that it was necessary for the leaf-hopper to feed upon a "curly" beet before being able to transmit the disease, and they obtained non-virulent nymphs by capturing them as they emerged from the eggs.

Many other mosaic-like diseases have since been shown to be carried by insects alone, and in many cases by a single species of insect. Among these may be mentioned Dickson's (2) transfer of raspberry mosaic with *Aphis rubiphila* Patch, Rankin's (5) transfer of leaf curl with the same aphid, and Kunkel's (3) transmission of aster yellows with *Cicadula sex-notata* Gill.

With this knowledge at hand, and after having spent some time studying the various diseases of raspberries in the field with Mr. R. B. Wilcox, the writer desired to learn some of the relationships of *Aphis rubiphila* Patch to the leaf curl of raspberries i. e.: 1. If the contagium was carried over winter within the egg, thus infecting the stem mothers from the fall generation; 2. If the disease was inherited by the young from the parents in viviparous reproduction; 3. If the disease was transmissible from susceptible varieties of reds to black caps and vice versa, or if the two groups of varieties had non-transferable strains of contagia; 4. And if this aphid was the only common insect carrier.

All the healthy plants used in these experiments were cut back so that the growths were suckers from below ground. Cages were placed over the plants before growth started and were removed only for making transfers or observations. Five aphids were transferred to each plant by means of a camel's hair brush and no difficulty was experienced in having colonies develop. Past observations of the author have indicated that the aphids were less disturbed by moving them bodily by this method than by permitting them to crawl off the wilting leaf of their own accord. Past workers made their transfers by placing aphid-covered leaves from diseased plants on healthy ones and experienced difficulty in establishing colonies. With this latter method, the aphids apparently become bewildered after the leaf has wilted and often fail to settle on the plant at all.

It is well known that only certain varieties of both red and black raspberries are susceptible to leaf curl. Cuthbert (red) and Hoosier (black cap) are two very susceptible varieties, and were used in the following experiments.

1. To determine whether the eggs carried the contagium thru the winter.

Eggs, laid by *Aphis rubiphila* Patch which had fed the previous fall on leaf curl raspberries of both Cuthbert and Hoosier varieties, were cut from the canes with a small piece of surrounding bark and placed in vials in out-of-door conditions. As soon as the eggs hatched one lot of young were placed under cages on small healthy suckers of the same variety from which they were taken. The other lot of aphids from the same eggs were first permitted to feed for two days on leaf curl plants before being transferred to healthy plants of respective varieties. The disease was not transmitted by the newly hatched aphids placed directly on healthy plants in 27 transfers, while those having first fed on diseased plants transmitted the disease in 26 out of 29 transfers in both the red and black varieties.

2. To determine whether the contagium was inherited by the offspring in parthenogenetic reproduction.

A number of adult female aphids from Cuthbert leaf curl plants were placed in glass vials loosely plugged with cotton for short periods each day. No food was present in the vials but reproduction continued, and the young, as soon as born, were removed to healthy plants. In this way the young would become infected only thru the ovaries other than thru external contact with the parents. In no case out of 20 such inoculations did the disease become apparent. The parents, when later transferred to healthy plants, transmitted the disease in 4 out of 7 cases.

3. To determine whether leaf curl is transmissible from black to red varieties and vice versa.

Healthy Cuthbert and Hoosier plants had aphids transferred to them from leaf curl plants of the opposite varieties. The 4 Hoosier plants inoculated with aphids from diseased Cuthberts did not become infected, but 5 of the 8 Cuthbert plants inoculated with aphids from leaf curl Hoosiers contracted the disease with the usual symptoms. The failure of the inoculations of the Hoosiers was probably due to the large size of the plants and to the less tender growth at the time the transfers were made. This is the first time, to the writer's knowledge, that leaf curl has been transmitted from either species to the other, and although not proven in both cases, it will probably be found to be interchangeable between the two.

4. To determine whether *Aphis rubiphila* Patch is the only common insect carrier of raspberry leaf curl.

Another aphid, *Amphorophora ribis* Kalt., very common on red raspberries, when placed on healthy Cuthberts after having fed on leaf curl plants, did not transmit the disease in a single case out of 20 transfers although vigorous colonies developed on each plant. Red spiders and two species (undetermined) of leaf-hoppers collected from leaf curl Cuthberts and placed on healthy ones also failed to be carriers of the disease.

Comparing raspberry leaf curl, then, with curly-top of beets, one species of insect only, in each case, has been proven a quite unfailing carrier and no mechanical method, cultural or otherwise, except possibly grafting, has been found to be a means of inoculation. In neither case does the insect inherit the infective agent from the parents either thru the egg, or, in case of the aphid, thru viviparous reproduction. The only case in mind at this time of an insect inheriting a mosaic disease was reported by McClintock and Smith (4). They concluded that *Macrosiphum solanifolii* Ashm. and *Myzus* (*Rhopalosiphum*) *persicae* Sulz. inherited the disease causing spinach blight in some cases as far removed as the fourth generation.

In neither the case of the leaf curl of raspberries nor that of the curly-top of sugar beets is it essential that the contagium be carried over winter within the insect so that new infections may be made. The leaf curl plant persists for two or more years after once becoming infected. The infective agent causing curly-top of beets is carried by the leaf-hopper to certain wild annuals (1) in the fall when a migration is made from the beet fields. Some of these wild plants, as *Erodium cicutarium*, become infected and serve as a source of the virus for the leaf-hoppers upon their return to the beets in the spring.

The aphids feeding on the diseased raspberry plants in the field carry the disease to other plants by crawling to adjacent healthy ones, thus enlarging the original areas. New locations are probably started by the quite numerous spring migrants, and by the crawling off of individuals from diseased suckers which have been uprooted and carried along the row by the cultivator.

Both the diseases known as "mosaic" and "leaf curl" have been shown to be transmitted by an insect and, no doubt, the other mosaic types of raspberry diseases such as "blue stem" or "streak" will also be found to be carried in a similar manner. But since raspberries are not generally sprayed, and because all the various mosaic diseases of this fruit have not been worked out to prove that spraying to kill the aphids would be the proper method of control, the present recommendation is to rogue out the diseased plants as soon as noticed and thus remove the sources

of contagia. This method may always prove to be the more economical as the plants never recover after they once become diseased, and it has been proven that roguing is practical commercially.

BIBLIOGRAPHY

1. CARSNER, EUBANKS. Susceptibility of various plants to "curly-top." Phytopathology. 9: 413–421. Sept. 1919.
2. DICKSON, B. T. Transfer of raspberry mosaic by aphids. Phytopathology. Vol. 10. Dec. 1920. (Abstr.).
3. KUNKEL, L. O. Insect transmission of aster yellows. Phytopathology. Vol. 14. pp. 54. Jan. 1924.
4. MCCLINTOCK, JAMES A. and SMITH, LOREN B. True nature of spinach blight and the relation of insects to its transmission. Jour. Agr. Res. 14: 1–6. July 1, 1918.
5. RANKIN, W. H. Interim Report of Dominion Botanist. pp. 30–60. March, 1922.
6. SHAW, HARRY B. The curly-top of beets. U. S. D. A., Bureau of Plant Industry. Bul. 181. 1910.
7. STAHL, C. F. and CARSNER, EUBANKS. Obtaining leaf-hoppers non-virulent as to curly-top. Jour. Agr. Res. 14: 393–4. Aug. 26, 1918.

A PRELIMINARY REPORT ON THE PREPARATION OF INSECTICIDE EMULSIONS WITH A COLLOIDAL CLAY

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ABSTRACT

This paper deals with the use of bentonite, a colloidal clay, as an emulsifier for kerosene, red engine oil, paraffin oil and furfural. The experiments included tests on potted bean plants for injury and tests on one species of aphid (*Amphorophora rhois* Monell) for insecticidal properties.

Because of the interesting and complex phenomena exhibited by emulsions, chemists have given them a great deal of study and have written copiously upon the subject. The entomologists, on the other hand, have been concerned primarily with the application of emulsions as insecticides. Since the advent of the kerosene emulsion in 1882 for insect control, other oils have been emulsified, miscible oils have been placed on the market and numerous emulsifiers have been advocated. Soap was the first emulsifying agent used by an entomologist, and is today probably the one most commonly used. Among other materials that have been used as emulsifying agents are albumen, casein, "Kayso," gelatin, milk, lime, finely divided silica, etc. Whether they are soaps or finely divided solids, emulsifiers are essentially of a colloidal nature. This implies that the particles when dispersed in a suitable medium shall have a diameter ranging from 0.1 μ to 1.0 μ μ. Particles of this size will remain suspended almost indefinitely.

The advantage that finely divided solids may have over soap are that no heat may be required for "solution" (peptization) and they are not subject to chemical influences as readily as is soap. Weston (1921) used a patented colloidal clay for preparing emulsions and it was his work that furnished the suggestion for the present investigations, to determine the possibility of using a colloidal clay known as bentonite, for the preparation of insecticide emulsions.

Deposits of bentonite occur in Wyoming, Death Valley, Calif., South Dakota, and Alberta, Canada. When fresh, this material has somewhat of a yellowish green color, taking on a cream or gray tint when exposed. The crude product is obtained in the form of rather large flakes and lumps. When wetted with water it swells somewhat like gelatin and becomes soapy to the touch. Chemically it shows no marked difference from the other typical clays.

Fifty per cent stock emulsions were prepared by allowing the bentonite to swell in water over night, then adding the oil and agitating with an ordinary bucket pump. The relative stability was determined by noting the separation in tubes and by centrifuging. Kerosene emulsions made with 8 and 10 grams of bentonite per 100 cc. of tap water were stable after 6 weeks. The stability and viscosity increased with the amount of bentonite used. With 10 grams and more per 100 cc. of water it was sometimes difficult to completely emulsify all of the oil because of the viscosity of the mixture and the consequent difficulty of manipulating it with the pump.

It was noted that emulsions with tap water were more stable than those made with distilled water. The tap water used is relatively high in calcium and magnesium and the radical HCO_3. It is likely that the clay was more readily peptized by tap water than by distilled water. The addition of certain electrolytes, particularly potassium carbonate (K_2CO_3), sodium carbonate (Na_2CO_3) and sodium bicarbonate($NaHCO_3$, baking soda) to distilled water increased the stability of the kerosene emulsions considerably.

Emulsions of paraffin oil, red engine oil, and furfural[1] were also made with bentonite. Less of the emulsifier was required to emulsify these oils than was required for kerosene. Paraffin and red engine oil emulsions made with 4 and 6 grams of bentonite per 100 cc. of tap water were stable after two weeks. The best furfural emulsions were made with 4 grams of bentonite per 100 cc. of water. Efforts to make stable emul-

[1]Although furfural is soluble in water, 9 parts in 100, an emulsion made from equal volumes of commercial furfural and water was considered as a 50 per cent emulsion.

sions of commercial furfural with soaps were negative. In addition to the emulsions prepared in 500 cc. volumes for laboratory studies, some were made in two gallon lots. For volumes of this size bentonite was used at the rate of 4 grams per 100 cc. of water (5.3 oz. per gal.) to emulsify paraffin and red engine oils, while 7 grams (9.3 oz. per gal.) was used in preparing kerosene emulsions. Emulsions of kerosene were also made with South Carolina kaolin, Georgia kaolin, Edgar's plastic kaolin and Kentucky ball clay, but these were relatively unstable compared to those made with bentonite.

It was evident from numerous tests on potted bean plants that emulsions of paraffin and red engine oils were much more injurious than either kerosene emulsion or three proprietary miscible oils. At strengths of 2 per cent, kerosene emulsion and three miscible oils caused practically no injury. Paraffin oil was slightly more injurious than red engine oil. A 10 per cent emulsion of furfural caused no apparent injury to beans; 15 per cent was slightly injurious and 20 per cent caused considerable injury.

Tests on one species of aphid (*Amphorophora rhois* Monell) indicated that paraffin oil and red engine oil emulsions compare favorably with the miscible oils. Kerosene emulsion was not as effective as the other oils. Furfural emulsions at a strength of 15 per cent gave approximately the same kill as the other sprays at 2 per cent strength. Emulsions made with soap were slightly more effective than those made with bentonite.

There is on the market, in addition to crude bentonite, a finished product that has been dehydrated and reduced to pass through a 200 to 250 mesh sieve. The indications are that these materials offer some possibilities as emulsifiers, but their use should be further investigated before recommendations are made.

Literature

1. Riley, C. V. The Kerosene Emulsion, its Origin, Nature and Increasing Usefulness. Proc. of the Soc. for the Promotion of Agr. Sci., p. 83, 1891.
2. Pickering, S. U. Emulsions. Jr. Chem. Soc. Vol., 91, p. 2002, 1907.
3. Weston, Frank E. Colloidal Clay and the Hydrolysis of Oils and Fats. Chem. Age (London), Vol. 4, p. 604, 1921.
4. Clayton, W. The Theory of Emulsions and Emulsification. P. Blakiston's Son & Co., 1923.
5. Burroughs, A. M. A New Method of Making Engine Oil Emulsions. Missouri Agr. Exp. Sta. Bul. 205, pp. 8, 1923.
6. Robinson, R. H. The Use of Skim Milk in the Preparation of Certain Spray Materials. Jr. Ec. Ent., Vol. 17, No. 3, p. 396, 1924.
7. Alexander, Jerome. Bentonite. Jr. Ind. and Engr. Chem. Vol. 16, No. 11 pp. 1140–42, Nov., 1924.

THE DELAYED DORMANT OIL SPRAY FOR KILLING APPLE RED-BUG EGGS

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ABSTRACT

This paper gives evidence that some degree of control of the red-bug (*Lygidea mendax* Reut.) can be expected by killing the eggs with the delayed dormant application of certain oil sprays. Several commercial miscible oils and emulsions were tried as well as home mixed calcium caseinate emulsions. In all cases decided advantage was noted in favor of oils.

The value of the delayed dormant application for killing the eggs of the red-bug (*Lygidea mendax* Reut.) has been suspected by the writer for several years. Coincident with experiments conducted during previous years, evidence was found where oil sprays had noticeably reduced the percentage of red-bug injury. This indication that the eggs of the red-bug succomb to oil sprays, led the writer during the seasons of 1923 and 1924 to conduct some experiments to determine this point. Applications were made with lime sulphur solution, home-mixed oil emulsions and several commercial oil mixtures. In every case the delayed-dormant oil sprays indicated a reduction in the percentage of red-bug injury. The experiments, carried on thus far, have not been extensive, but seem to show the possibilities along this line.

Home mixed emulsions were used after the formula recommended by Burroughs (1923)[1] using, however, a larger amount of calcium caseinate. A pound or a pound and a half of calcium caseinate was mixed with a gallon of water to which three gallons of red-engine oil or kerosene oil was added, mixing them thoroughly by means of a pump and spray nozzle. This was diluted with 99 gallons of water giving a three per cent oil emulsion. Texaco "Nabob" oil was used in making all the engine oil emulsions. The larger amount of calcium caseinate was used because it made a smoother mixture and lessened the possibility of the emulsion breaking down. In all the work no injury was noted on the foliage or no difficulty experienced with the home-mixed emulsions.

Several commercial oils were used including; Sunoco oil, made by the Sun oil Co., Hygrade oil made by the Hagerstown spray Co., and Scalecide.

It was discovered that neither lime-sulphur, applied in the dormant or delayed dormant nor oils applied in the dormant, would kill the eggs of the red-bug. Attention was then turned to the application of oils in the delayed-dormant. These sprays were applied after the buds had burst

[1]Burroughs, A. M. Mo. Agric. Exp. Sta. Bull. 205, 1923.

and the young leaves were protruding a half to three quarters of an inch from the buds. Lime sulphur, even when applied at this late date, did not give control but the oils were effective in killing the eggs. This is comparable with results obtained with red-spider. It is difficult, however, to see how the oils can penetrate to the eggs of the red-bug which are inserted in the twigs. Parker (1923),[2] speaking of insect eggs in general, says that the chitinous covering of an egg is disintegrated by the oils and they are finally absorbed by the egg, causing a coagulation of the embryonic protoplasm. Possibly a similar action takes place in the red-bug eggs when oil comes in contact with them.

For brevity, the work of 1923 and 1924 is summarized in the following tables. These show very plainly an indication of red-bug control through the use of commercial or home-mixed oils. In some cases the amount of fruit at picking time was small thus making it impossible to secure comprehensive figures. It will be noticed that two methods of securing records were employed. (1) Foliage counts, made during the early part of the summer, indicating leaves stippled by red-bugs and unstippled leaves. (2) Fruit counts, indicating infested and free fruits. In making such counts, only fruits were taken into account that were unmistakably injured by red-bugs. This eliminated possibilities of error through the introduction of counts of certain injuries closely resembling those caused by red-bugs.

FOLIAGE COUNTS, NEWCOMER ORCHARD, 1923

Material	Application	No. of leaf clusters counted	No. of leaf clusters infested	Percentage red-bug infestation
Lime sulphur	D.D.[1]	1857	131	6.3
Scalecide	D.D.	1386	0	.0

[1]DD = Delayed dormant.

FOLIAGE COUNTS, KELLER ORCHARD, 1924
(May 20th)

Material	Application	No. trees counted	No. of leaf clusters counted	No. of leaf clusters infested	Percentage red-bug infestation
Sunoco	D.D.	5	2008	113	5.6
Eng. Oil emulsion	D.D.	5	1911	180	9.4
Lime sulphur	D.D	5	700	81	11.5
Check	D.D.	1	919	56	6.0[2]

[2]This low percentage is probably due to the fact that the counts were made from a single tree.

[2]Parker, T. Bull. Bur. Biol. Technal. 2 No. 11–12: 105–107, 1923.

FOLIAGE COUNTS, KELLER ORCHARD, 1924
(Made on July 1st.)

Material	Application	No. trees counted	No. of leaf clusters counted	No. of leaf clusters infested	Percentage red-bug infestation
Sunoco	D.D.	5	1207	106	8.7
Eng. Oil emulsion	D.D.	5	1204	90	7.4
Lime sulphur	D.D.	5	919	231	25.1
Check		1	474	39	7.9[a]

[a]This low percentage is probably due to the fact that the counts were made from a single tree.

FRUIT COUNTS, KELLER ORCHARD, 1924

Material	Application	No. trees counted	No. of leaf clusters counted	No. of leaf clusters infested	Percentage red-bug infestation
Sunoco	D.D.	5	345	18	5.2
Eng. Oil emulsion	D.D.	5	1356	68	5.0
Lime sulphur	D.D.	5	1460	220	15.0

FOLIAGE COUNTS, PITZER ORCHARD, 1924

Material	Application	No. trees counted	No. of leaf clusters counted	No. of leaf clusters infested	Percentage red-bug infestation
Sunoco	D.D.	5	1674	118	7.0
Eng. Oil emulsion	D.D.	5	974	114	14.7[1]
Kerosene emulsion	D.D.	5	2004	159	7.9
Hygrade	D.D.	5	2181	42	1.8
Lime sulphur	D.D.	5	1224	194	15.8
Check		1	643	26	4.0[2]

[1]It is difficult to explain the high percentage here.
[2]The low percentage here is probably due to the fact that the counts were taken from a single tree.

FRUIT COUNTS, PITZER ORCHARD, 1924

Material	Application	No. trees counted	No. of leaf clusters counted	No. of leaf clusters infested	Percentage red-bug infestation
Sunoco	D.D.	41	245	10	4.0
Eng. Oil emulsion	D.D.	45	467	32	6.8
Kerosene emulsion	D.D.	11	70	4	5.6
Hygrade	D.D.	10	46	2	4.3
Lime sulphur	D.D.	5	530	90	16.9
Check		6	260	42	16.1

FOLIAGE COUNTS, LAUVER ORCHARD, 1924

Material	Application	No. trees counted	No. of leaf clusters counted	No. of leaf clusters infested	Percentage red-bug infestation
Sunoco	Dormant	5	2101	306	14.5
Sunoco	D.D.	5	2360	44	1.9
Scalecide	D.D.	5	1005	32	3.1
Lime sulphur	D.D.	5	1936	207	14.4

FRUIT COUNTS, JACOBS ORCHARD, 1924

Material	Application	No. trees counted	No. of leaf clusters counted	No. of leaf clusters infested	Percentage red-bug infestation
Hygrade	D.D.	12	1006	12	1.1
Sunoco	D.D.	13	540	9	1.6
Lime sulphur	D.D.	12	574	28	4.8

The foregoing figures taken entirely from orchard work seem to indicate that oils will kill a large percentage of the eggs of the red-bug. Just what part this may play in control work is hard to say as the application of nicotine sulphate at the time of the calyx spray is a standard and satisfactory means of controlling the red-bug. It does, however, add weight to the value of the delayed dormant application and can be considered among the uses of oil at this time.

The Sweep Method vs. The Count Method For Determining Grasshopper Infestation. Grasshoppers are the most destructive insects attacking cereal and forage crops in Colorado. This makes it necessary for this experiment station to keep under way experiments to test different poisoning agents and carriers for these poisons. This, of course, requires the determining of grasshopper infestation, and it is important that this be as accurate as possible.

There are two methods used in estimating grasshopper infestation. First, the sweep method, consisting of a series of sweepings, usually 50 sweeps of the net to a sweeping; second, the count method, consisting of a count of the actual number of hoppers within a given area. This can be done by constructing a shallow box or frame covered with a screen or canvas. The box should be of known dimensions, say one square yard, and fitted with a series of ropes (one from each corner) so that the workers may stand some distance from the trap, and avoid disturbing the grasshoppers, when operating. This apparatus, quickly dropped, will trap all grasshoppers within that area covered by it. These hoppers may be killed with a small amount of calcium cynaide dust, and counted. From a series of such counts may be estimated very closely the number of hoppers within a field.

Both of these methods are used. The sweep method probably is the more common one. The writers felt that the two methods should be compared in order to determine how uniform the results would be.

The work was done on an alfalfa field about 12 miles northwest of Fort Collins. The poisoning agent used was sodium arsenite, one pint to 100 pounds of bran, with amyl acetate, syrup, and water added as recommended in the standard formulas.

The hoppers present were mostly *Melanoplus femur-rubrum* and *M. bivittatus*. From the count of 1607 hoppers collected, they were assorted as follows:

M. femur-rubrum	752
M. bivittatus	183
M. atlanis	53
M. coccineipes	2
M. luridus	1
Immature hoppers	616

Results obtained showing the comparison of the two methods are given in Tables 1 and 2.

TABLE 1. Data from count method made Sept. 15

Total number of hoppers, dead and alive, on 10 square yards, Sept. 15, 1924	214
Total number of dead hoppers on 10 square yards, Sept. 15	209
Average number of living hoppers per square yard, record of Sept. 15	0.5
Average number of living hoppers per square yard, record of Sept. 8	26.4

Percent control, 92.9, record of Sept. 15

TABLE 2. Sweeping records, 50 sweeps to a record

Date 1924	1	2	Total live hoppers	Per cent dead
Sept. 8	248	240	588	0
Sept. 15	22	16	38	93.5

Per cent control, 93.5

Daily observations and count records were made from Sept. 8 to Sept. 15, inclusive.[1] The counts obtained from September 9 to September 13 could not be fairly used in a comparison of the efficiency of the two methods, because the sweep method will always give a higher per cent of control than the count method for a few days. This is due to the fact that sick hoppers do not jump, therefore they are not caught in the net and are counted as dead.

The experiments show the two methods to be about equally accurate, so far as taking the infestation or computing the per cent of kill obtained is concerned, but, on the whole, the writers are convinced that the sweep method is the better. It gives approximately the same result as the count method and requires only one man, is easier on the worker, and requires much less time.

J. L. HOERNER AND GEORGE S. LANGFORD, CO-AUTHORS

[1]The long period required in killing the hoppers is due to the slow acting poison (sodium arsenite) used.

COMMON NAMES OF INSECTS APPROVED FOR GENERAL USE BY THE AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

The following list of common names was prepared by the Committee on Nomenclature of the American Association of Economic Entomologists in conformity with instructions given by the Association at its 32d Annual meeting held in St. Louis during the winter of 1919–1920, and such subsequent instructions as have been given at succeeding meetings. It includes all of those names formerly approved by this Association and such other names as were submitted to the members of the Association since its last regular meeting, and which have met with their approval.

These common names have been revised and made to conform to a common practice, as far as possible, in regards to the use of the hyphen and run-together. Previously adopted schemes of name construction have been disregarded and the simplest possible form followed in conformity with the expressed desire of the Association at its last regular meeting.

In the few cases where the Association has inadvertently adopted two names for an insect and where it was evident that the two names were not regional, nor otherwise desirable, the Committee has accepted the simplest and most generally used form.

For convenience in using this list it has been arranged alphabetically, first, in the order of common names and, second, in the order of technical names. The technical names are those appearing in the most recent and generally accepted catalog of the group in question. In a few cases where a change from catalog usage was generally accepted this change has been followed.

The letter following the common name indicates the order to which the insect belongs. This is for the convenience of such editorial workers as are not familiar with entomological nomenclature.

This list supersedes and suppresses all previous lists and the American Association of Economic Entomologists strongly urges that its members, and such others as are in sympathy with its policies, use every effort to have these names used in all publications emanating from the institutions with which they are connected.

KEY TO SYMBOLS

A....Acarina	F....Forficulidae	L...Lepidoptera
C....Coleoptera	H...Hemiptera	O...Orthoptera
D....Diptera	Hy..Hymenoptera	T...Thysanoptera
	N...Neuropteroids	

INSECTS LISTED BY COMMON NAMES

Achemon sphinx (L) ..... Pholus achemon Drury
Alaska spruce beetle (C) ..... Dendroctonus borealis Hopk.
Alfalfa caterpillar (L) ..... Eurymus eurytheme Boisd.
Alfalfa looper (L) ..... Autographa californica Speyer
Alfalfa weevil (C) ..... Phytonomus posticus (Gyll.)
Allegheny spruce beetle (C) ..... Dendroctonus punctatus Lec.
American cockroach (O) ..... Periplaneta americana L.
American dagger moth (L) ..... Acronycta americana Harr.
Angoumois grain moth (L) ..... Sitotroga cerealella Ol.
Angular-winged katydid (O) ..... Microcentrum retinerve Burm.
Apple aphid (H) ..... Aphis pomi DeG.
Apple curculio (C) ..... Tachyptrellus quadrigibbus (Say)
Apple grain aphid (H) ..... Rhopalosiphum prunifoliae (Fitch)
Apple leaf skeletonizer (L) ..... Psorosina hammondi (Riley)
Apple leaf trumpet miner (L) ..... Tischeria malifoliella Clem.
Apple leafhopper (H) ..... Empoasca mali LeB.
Apple maggot (D) ..... Rhagoletis pomonella Walsh
Apple seed chalcid (Hy) ..... Syntomaspis druparum (Boh.)
Apple twig beetle (C) ..... Hypothenemus hispidulus (Lec.)
Apple twig borer (C) ..... Amphicerus bicaudatus (Say)
Arborvitae leaf miner (L) ..... Argyresthia thuiella Pack.
Argentine ant (Hy) ..... Iridomyrmex humilis Mayr.
Argus tortoise beetle (C) ..... Chelymorpha cassidea (Fab.)
Arizona pine beetle (C) ..... Dendroctonus arizonicus Hopk.
Army cutworm (L) ..... Chorizagrotis auxiliaris Grote
Armyworm (L) ..... Cirphis unipuncta (Haw.)
Ash-gray blister beetle (C) ..... Macrobasis unicolor (Kirby)
Asparagus beetle (C) ..... Crioceris asparagi (L.)
Asparagus miner (D) ..... Agromyza simplex Loew
Australian cockroach (O) ..... Periplaneta australasiae Fab.
Australian-pine borer (C) ..... Chrysobothris tranquebarica (Gmel.)

Bagworm (L) ..... Thryidopteryx ephemeraeformis Haw.
Bald-face hornet (Hy) ..... Vespa maculata L.
Banana root borer (C) ..... Cosmopolites sordidus Germ.
Banded flea beetle (C) ..... Systena taeniata (Say)
Barnacle scale (H) ..... Ceroplastes cirripediformis Comst.
Bean leaf beetle (C) ..... Cerotoma trifurcata (Forst.)
Bean leaf roller (L) ..... Goniurus proteus (L.)
Bean weevil (C) ..... Mylabris obtectus (Say)
Bedbug (H) ..... Cimex lectularius L.
Beet armyworm (L) ..... Laphygma exigua Hb.
Beet leaf beetle (C) ..... Monoxia puncticollis (Say)
Beet leafhopper (H) ..... Eutettix tenellus (Baker)
Beet webworm (L) ..... Loxostege sticticalis L.
Black blister beetle (C) ..... Epicauta pennsylvanica (DeG.)
Black carpet beetle (C) ..... Attagenus piceus Ol.

Black cherry aphid (H) ..... Myzus cerasi (Fab.)
Black cutworm (L) ..... Agrotis ypsilon Rott.
Black-headed fireworm (L) ..... Rhopobota naevana Hb.
Black Hills beetle (C) ..... Dendroctonus ponderosae Hopk.
Black-horned tree cricket (O) ..... Oecanthus nigricornis Walk.
Black horsefly (D) ..... Tabanus atratus Fab.
Black-legged tortoise beetle (C) ..... Jonthonota nigripes (Ol.)
Black peach aphid (H) ..... Anuraphis persicae-niger (Smith)
Black scale (H) ..... Saissetia oleae Bern.
Black swallowtail (L) ..... Papilio polyxenes Fab.
Black thread scale (H) ..... Ischnaspis longirostris Sign.
Black turpentine beetle (C) ..... Dendroctonus terebrans (Ol.)
Blood-sucking conenose (H) ..... Triatoma sanguisuga (Lec.)
Blueberry maggot (D) ..... Rhagoletis pomonella Walsh
Body louse (H) ..... Pediculus vestimenti Nitz.
Boll weevil (C) ..... Anthonomus grandis Boh.
Boll worm (L) ..... Heliothis obsoleta Fab.
Booklouse (N) ..... Troctes divinatoria Mull.
Boxelder aphid (H) ..... Periphyllus negundinis (Thomas)
Boxelder bug (H) ..... Leptocoris trivittatus (Say)
Boxwood leaf miner ..... Monarthropalpus buxi Labou.
Bristly cutworm (L) ..... Polia renigera Steph.
Bristly rose slug (Hy) ..... Cladius isomerus Norton
Broad-bean weevil (C) ..... Mylabris rufimanus Boh.
Bronze birch borer (C) ..... Agrilus anxius Gory
Bronzed cutworm (L) ..... Nephelodes emmedonia Cram.
Brown spider beetle (C) ..... Ptinus brunneus Dufts
Brown-tail moth (L) ..... Euproctis chrysorrhoea L.
Buck moth (L) ..... Hemileuca maia Drury
Buffalo treehopper (H) ..... Ceresa bubalus (Fab.)

Cabbage aphid (H) ..... Brevicoryne brassicae (L.)
Cabbage curculio (C) ..... Ceutorhynchus rapae Gyll.
Cabbage looper (L) ..... Autographa brassicae Riley
Cabbage maggot (D) ..... Hylemyia brassicae (Bouchè)
Cabbage seed-stalk curculio (C) ..... Ceutorhynchus quadridens (Panz.)
Cabbage webworm (L) ..... Hellula undalis Fab.
Cactus scale (H) ..... Diaspis echinocacti (Bouchè)
Cadelle (C) ..... Tenebroides mauritanicus (L.)
California oak worm (L) ..... Phryganidia californica Pack.
California red scale (H) ..... Chrysomphalus aurantii Mask.
Camphor thrips (T) ..... Cryptothrips floridensis Watson
Carolina grasshopper (O) ..... Dissosteira carolina (L.)
Carolina mantis (O) ..... Stagmomantis carolina Johan.
Carpenter worm (L) ..... Prionoxystus robiniae Peck
Carpet beetle (C) ..... Anthrenus scrophulariae (L.)
Carpet moth (L) ..... Trichophaga tapetzella L.
Carrot beetle (C) ..... Ligyrus gibbosus (DeG.)

Carrot rust fly (D) ..... Psila rosae Fab.
Case-bearing clothes moth (L) ..... Tinea pellionella L.
Catalpa sphinx (L) ..... Ceratomia catalpae Boisd.
Cat follicle mite (A) ..... Demodex cati Megnin
Cattle follicle mite (A) ..... Demodex bovis Stiles
Cattle tick (A) ..... Boophilus annulatus Say
Cecropia moth (L) ..... Samia cecropia L.
Celery looper (L) ..... Autographa falcifera Kirby
Celery worm (L) ..... Papilio polyxenes Fab.
Chaff scale (H) ..... Parlatoria pergandei Comst.
Chain-spotted geometer (L) ..... Cingilia catenaria Drury
Changa (O) ..... Scapteriscus vicinus Scudd.
Cheese skipper (D) ..... Piophila casei L.
Cherry fruit fly (D) ..... Rhagoletis cingulata Loew
Cherry maggot (D) ..... Rhagoletis cingulata Loew
Cherry scale (H) ..... Aspidiotus forbesi Johns.
Chestnut weevil (C) ..... Balaninus rectus Say
Chigoe (A) ..... Tunga penetrans (L.)
Chinch bug (H) ..... Blissus leucopterus (Say)
Chinese mantis (O) ..... Tenodera sinensis (Sauss.)
Chrysanthemum gall midge (D) ..... Diarthronomyia hypogaea Loew
Chrysanthemum leaf miner (D) ..... Napomyza chrysanthemi Kowarz
Cicada (H) ..... Cicada spp.
Cigar case bearer (L) ..... Coleophora fletcherella Fern.
Cigarette beetle (C) ..... Lasioderma serricorne (Fab.)
Citrus blackfly (H) ..... Aleurocanthus woglumi Ashby
Citrus mealybug (H) ..... Pseudococcus citri Risso
Citrus rust mite (A) ..... Eriophyes oleivorus Ashm.
Citrus whitefly (H) ..... Dialeurodes citri (Ashm.)
Cloudy-winged whitefly (H) ..... Dialeurodes citrifolii (Morg.)
Clover aphid (H) ..... Anuraphis bakeri (Cowan)
Clover cutworm (L) ..... Scotogramma trifolii Rott.
Clover hay worm (L) ..... Hypsopygia costalis Fab.
Clover head caterpillar (L) ..... Laspeyresia interstinctana Clem.
Clover leaf midge (D) ..... Dasyneura trifolii Loew
Clover leaf weevil (C) ..... Hypera punctata (Fab.)
Clover mite (A) ..... Bryobia praetiosa Koch
Clover root borer (C) ..... Hylastinus obscurus (Marsham)
Clover seed chalcid (Hy) ..... Bruchophagus funebris Howard
Clover stem borer (C) ..... Languria mozardi Latr.
Cluster fly (D) ..... Pollenia rudis Fab.
Cocoanut mealybug (H) ..... Pseudococcus nipae Mask.
Codling moth (L) ..... Carpocapsa pomonella L.
Coffee-bean weevil (C) ..... Araecerus fasciculatus (DeG.)
Colorado pine beetle (C) ..... Dendroctonus approximatus Dz.
Colorado potato beetle (C) ..... Leptinotarsa decemlineata (Say)
Corn billbugs (C) ..... Sphenophorus spp. (Living on corn)
Corn blotch leaf miner (D) ..... Agromyza parvicornis Loew

Corn ear worm (L) ..... Heliothis obsoleta Fab.
Corn root aphid (H) ..... Anuraphis maidi-radicis (Forbes)
Corn root worm (C) ..... Diabrotica longicornis (Say)
Cotton aphid (H) ..... Aphis gossypii Glover
Cotton stainer (H) ..... Dysdercus suturellus (H.-Sch.)
Cottony-cushion scale (H) ..... Icerya purchasi Mask.
Cottony maple scale (H) ..... Pulvinaria innumerabilis Rathv.
Coulee cricket (O) ..... Peranabrus scabricollis Thoms.
Cowpea weevil (C) ..... Mylabris chinensis (L.)
Cranberry fruit worm (L) ..... Mineola vaccinii Riley
Cranberry girdler (L) ..... Crambus hortuellus Hb.
Cranberry spanworm (L) ..... Cleora pampinaria Guen.
Crazy ant (Hy) ..... Prenolepis longicornis Latr.
Cross-striped cabbage worm (L) ..... Evergestis rimosalis Guen.
Cuban-laurel thrips (T) ..... Gynaikothrips uzeli Zimm.
Currant aphid (H) ..... Myzus ribis (L.)
Currant borer (L) ..... Synanthedon tipuliformis L.
Currant fruit fly (D) ..... Epochra canadensis Loew
Currant spanworm (L) ..... Itame ribearia Fitch
Currant stem girdler (Hy) ..... Janus integer Norton
Cyclamen mite (A) ..... Tarsonemus pallidus Banks

Dark meal worm (C) ..... Tenebrio obscurus Fab.
Dark-sided cutworm (L) ..... Euxoa messoria Harr.
Deer flies (D) ..... Chrysops spp.
Devastating grasshopper (O) ..... Melanoplus devastator Scudd.
Diamond-back moth (L) ..... Plutella maculipennis Curtis
Differential grasshopper (O) ..... Melanoplus differentialis Thomas
Dingy cutworm (L) ..... Feltia subgothica Haw.
Dobson fly ..... Corydalis cornuta (L.)
Dog follicle mite (A) ..... Demodex canis Leydig
Douglas-fir beetle (C) ..... Dendroctonus pseudotsugae Hopk.
Drug-store weevil (C) ..... Sitodrepa panicea (L.)

Eastern larch beetle (C) ..... Dendroctonus simplex Lec.
Eastern spruce beetle (C) ..... Dendroctonus piceaperda Hopk.
Eastern tent caterpillar (L) ..... Malacosoma americana Fab.
Eight-spotted forester (L) ..... Alypia octomaculata Fab.
Elm borer (C) ..... Saperda tridentata Ol.
Elm case bearer (L) ..... Coleophora limosipennella Dup.
Elm leaf beetle (C) ..... Galerucella xanthomelaena (Schrank)
Elm leaf miner (L) ..... Kaliosysphinga ulmi Sund.
Elm sawfly (Hy) ..... Cimbex americana Leach
Elm spanworm (L) ..... Ennomos subsignarius Hb.
Engelmann-spruce beetle (C) ..... Dendroctonus engelmanni Hopk.
English grain aphid (H) ..... Macrosiphum granarium (Kirby)
Euonymus scale (H) ..... Chionaspis euonymi Comst.
European elm scale (H) ..... Gossyparia spuria Modeer

European fruit scale (H) ..... Aspidiotus ostreaeformis Curt.
European peach scale (H) ..... Lecanium persicae Fab.
European spruce beetle (C) ..... Dendroctonus micans Kug.
Eyed click beetle (C) ..... Alaus oculatus (L.)
Eye-spotted budmoth (L) ..... Spilonota ocellana Shiff.

Fall armyworm (L) ..... Laphygma frugiperda S. & A.
Fall canker worm (L) ..... Alsophila pometaria Harr.
Fall webworm (L) ..... Hyphantria cunea Drury
False chinch bug (H) ..... Nysius ericae (Schill.)
False potato beetle (C) ..... Leptinotarsa juncta (Germ.)
Fern scale (H) ..... Hemichionaspis aspidistrae Sign.
Field cricket (O) ..... Gryllus assimilis Fab.
Fire ant (Hy) ..... Solenopsis geminata Fab.
Flat-headed apple tree borer (C) ..... Chrysobothris femorata (Ol.)
Florida red scale (H) ..... Chrysomphalus ficus Ashm.
Florida wax scale (H) ..... Ceroplastes floridensis Comst.
Flour beetle (C) ..... Tribolium spp.
Flower thrips (T) ..... Frankliniella tritici (Fitch)
Forest tent caterpillar (L) ..... Malacosoma disstria Hb.
Four-lined plant bug (H) ..... Poecilocapsus lineatus (Fab.)
Four-spotted tree cricket (O) ..... Oecanthus nigricornis quadripunctatus Beut.
Fruit tree leaf roller (L) ..... Archips argyrospila Walk.
Fuller's rose beetle (C) ..... Pantomorus fulleri (Horn)

Gall-making maple borer (C) ..... Xylotrechus aceris Fisher
Garden webworm (L) ..... Loxostege similalis Guen.
German cockroach (O) ..... Blatella germanica L.
Giant stag beetle (C) ..... Lucanus elaphus Fab.
Giant water bug (H) ..... Lethocerus americanus Comst.
Glassy cutworm (L) ..... Sidemia devastator Brace
Globose scale (H) ..... Lecanium prunastri Fonsc.
Gloomy scale (H) ..... Chrysomphalus tenebricosus Comst.
Glover's scale (H) ..... Lepidosaphes gloveri Pack.
Goat follicle mite (A) ..... Demodex capri Railliet
Golden tortoise beetle (C) ..... Metriona bicolor (Fab.)
Gooseberry fruit worm ..... Zophodia grossulariae Riley
Gooseberry witch-broom aphid (H) ..... Myzus houghtonensis (Troup)
Granary weevil (C) ..... Calendra granaria (L.)
Granulate cutworm (L) ..... Feltia annexa Treit.
Grape berry moth (L) ..... Polychrosis viteana Clem.
Grape blossom midge (D) ..... Contarinia johnsoni Sling.
Grape cane gall maker (C) ..... Ampeloglypter sesostris (Lec.)
Grape colaspis (C) ..... Colaspis brunnea (Fab.)
Grape curculio (C) ..... Craponius inaequalis (Say)
Grape flea beetle (C) ..... Haltica chalybea Ill.
Grape leaf folder (L) ..... Desmia funeralis Hb.
Grape leafhopper (H) ..... Erythroneura comes (Say)

Grape leaf skeletonizer (L) ..... Harrisina americana Guer.
Grape phylloxera (H) ..... Phylloxera vitifoliae (Fitch)
Grape plume moth (L) ..... Oxyptilus periscelidactylus Fitch
Grape root borer (L) ..... Paranthrene polistiformis (Harr.)
Grape root worm (C) ..... Fidia viticida Walsh
Grape sawfly (Hy) ..... Erythraspides pygmaea (Say)
Grape scale (H) ..... Aspidiotus uvae Comst.
Grape seed chalcid (Hy) ..... Evoxysoma vitis Saunders
Grape vine aphid (H) ..... Aphis illinoisensis Shimer
Grass thrips (T) ..... Aphanothrips obscurus (Mull.)
Gray blister beetle (C) ..... Epicauta cinerea (Forst.)
Greedy scale (H) ..... Aspidiotus rapax Comst.
Green clover worm (L) ..... Plathypena scabra Fab.
Green fruit worm (L) ..... Graptolitha antennata Walk.
Greenhouse leaf tyer (L) ..... Phlyctaenia ferrugalis Hb.
Greenhouse stone cricket (O) ..... Diestrammena japonica Blatch.
Greenhouse thrips (T) ..... Heliothrips haemorrhoidalis Bouché
Greenhouse whitefly (H) ..... Trialeurodes vaporariorum (Westw.)
Green June beetle (C) ..... Cotinis nitida (L.)
Green peach aphid (H) ..... Myzus persicae (Sulz.)
Green shield scale (H) ..... Pulvinaria psidii Mask.
Green stinkbug (H) ..... Acrosternum hilaris (Say)
Gypsy moth (L) ..... Porthetria dispar L.

Hag moth (L) ..... Phobetron pithecium S. & A.
Harlequin bug (H) ..... Murgantia histrionica Hahn
Head louse (H) ..... Pediculus humanus L.
Helgramite (N) ..... Corydalis cronuta L.
Hemispherical scale (H) ..... Saissetia hemisphaerica Targ.
Hessian fly (D) ..... Phytophaga destructor (Say)
Hickory bark beetle (C) ..... Scolytus quadrispinosus Say
Hickory borer (C) ..... Cyllene robiniae (Forst.)
Hickory horned devil (L) ..... Citheronia regalis Fab.
Hickory tussock moth (L) ..... Halisidota caryae Harr.
Hide beetle (C) ..... Dermestes vulpinus Fab.
Hog follicle mite (A) ..... Demodex phylloides Csokor
Hog louse (H) ..... Haematopinus suis L.
Honey bee (Hy) ..... Apis mellifera L.
Hop aphid (H) ..... Phorodon humuli (Schrank)
Hop flea beetle (C) ..... Psylliodes punctulata Melsh.
Hop looper (L) ..... Hypena humuli Harr.
Horn fly (D) ..... Haematobia irritans L.
Horse botfly (D) ..... Gastrophilus intestinalis DeG.
Horse follicle mite (A) ..... Demodex equi Railliet
Horse-radish flea beetle (C) ..... Phyllotreta armoraciae (Koch)
House cricket (O) ..... Gryllus domesticus L.
House fly (D) ..... Musca domestica L.
Howard's scale (H) ..... Aspidiotus howardi Ckll.

Imbricated snout beetle (C) ..... Epicaerus imbricatus Say
Imperial moth (L) ..... Basilona imperialis Drury
Imported cabbage worm (L) ..... Pieris rapae L.
Imported currant worm (Hy) ..... Pteronidea ribesii (Scop.)
Indian-meal moth (L) ..... Plodia interpunctella Hb.
Introduced pine sawfly (Hy) ..... Diprion simile (Hartig)
Io moth (L) ..... Automeris io Fab.
Iris borer (L) ..... Macronoctua onusta Grote

Jeffrey-pine beetle (C) ..... Dendroctonus jeffreyi Hopk.

Lappet moth (L) ..... Epicnaptera americana Harr.
Larch case bearer (L) ..... Coleophora laricella Hb.
Larch sawfly (Hy) ..... Nematus erichsoni Hartig
Larder beetle (C) ..... Dermestes lardarius L.
Large chestnut weevil (C) ..... Balaninus proboscideus (Fab.)
Larger Mexican pine beetle (C) ..... Dendroctonus parallelocollis Chap.
Leaf crumpler (L) ..... Mineola indigenella Zell.
Leaf-footed bug (H) ..... Leptoglossus phyllopus (L.)
Leopard moth (L) ..... Zeuzera pyrina L.
Lesser apple worm (L) ..... Laspeyresia prunivora Walsh
Lesser corn stalk borer (L) ..... Elasmopalpus lignosellus Zell.
Lilac borer (L) ..... Podosesia syringae Harr.
Lime-tree looper (L) ..... Erannis tiliaria Harr.
Lined spittle bug (H) ..... Philaenus lineatus (L.)
Linden borer (C) ..... Saperda vestita Say
Locust borer (C) ..... Cyllene robiniae (Forst.)
Lodgepole-pine beetle (C) ..... Dendroctonus murrayanae Hopk.
Lubber grasshopper (O) ..... Brachystola magna Gir.
Luna moth (L) ..... Tropaea luna L.

Magnolia scale (H) ..... Neolecanium cornuparvum Thro.
Mango seed weevil (C) ..... Sternochestus mangifera Fab.
Margined blister beetle (C) ..... Epicauta cinerea marginata (Fab.)
Masked hunter (H) ..... Reduvius personatus (L.)
Meadow plant bug (H) ..... Miris dolabratus (L.)
Meal moth (L) ..... Pyralis farinalis L.
Mealy plum aphid (H) ..... Hyalopterus arundinis (Fab.)
Mediterranean flour moth (L.) ..... Ephestia kuehniella Zell.
Mediterranean fruit fly (D) ..... Ceratitis capitata Wied.
Melon aphid (H) ..... Aphis gossypii Glov.
Melon worm (L) ..... Diaphania hyalinata L.
Mexican bean beetle (C) ..... Epilachna corrupta Muls.
Mining scale (H) ..... Howardia biclavis Comst.
Monarch butterfly (L) ..... Danaus archippus Fab.
Mottled tortoise bettle (C) ..... Chirida guttata (Ol.)
Mountain pine beetle (C) ..... Dendroctonus monticolae Hopk.
Mourning-cloak butterfly (L) ..... Aglais antiopa L.
Mulberry whitefly (H) ..... Tetraleurodes mori (Quaint.)

Narcissus bulb fly (D) ..... Merodon equestris Fab.
Negrobug (H) ..... Thyreocoris pulicarius (Germ.)
New York weevil (C) ..... Ithycerus noveboracensis (Forst.)
Northern mole cricket (O) ..... Gryllotalpa hexadactyla Perty

Obscure scale (H) ..... Chrysomphalus obscurus Comst.
Onion maggot (D) ..... Hylemyia antiqua Meig.
Onion thrips (T) ..... Thrips tabaci L.
Orange dog (L) ..... Papilio thoas L.
Orange maggot (D) ..... Trypeta ludens Loew
Orange scale (H) ..... Aonidiella aurantii Mask.
Orange-striped oak worm (L) ..... Anisota senatoria S. & A.
Orange thrips (T) ..... Scirtothrips citri Moulton
Oriental cockroach (O) ..... Blatta orientalis L.
Oriental moth (L) ..... Cnidocampa flavescens Walk.
Oyster-shell scale (H) ..... Lepidosaphes ulmi L.
Painted beauty (L) ..... Vanessa virginiensis Drury
Pale-striped flea beetle (C) ..... Systena taeniata blanda (Melsh.)
Pale tussock moth (L) ..... Halisidota tessellaris S. &A.
Palmer worm (L) ..... Dichomeris ligulella Hb.
Papaya fruit fly (D) ..... Toxotrypana curvicauda Gers.
Parsley worm (L) ..... Papilio polyxenes Fab.
Parsnip webworm (L) ..... Depressaria heracliana DeG.
Pavement ant (Hy) ..... Tetramorium caespitum L.
Pea aphid (H) ..... Illinoia pisi (Kalt.)
Pea moth (L) ..... Laspeyresia nigricana Steph.
Pea weevil (C) ..... Mylabris pisorum (L.)
Peach bark beetle (C) ..... Phthorophloeus liminaris (Harr.)
Peach borer (L) ..... Aegeria exitiosa Say
Peach twig borer (L) ..... Anarsia lineatella Zell.
Pear leaf blister mite (A) ..... Eriophyes pyri Pagnst.
Pear midge (D) ..... Contarinia pyrivora Riley
Pear plant bug (H) ..... Lygus communis Knight
Pear psylla (H) ..... Psylla pyri L.
Pear slug (Hy) ..... Eriocampoides limacina Retz.
Pear thrips (T) ..... Taeniothrips inconsequens Uzel
Pecan case bearer (L) ..... Mineola indiginella nebulella Riley
Pecan weevil (C) ..... Balaninus caryae Horn
Periodical cicada (H) ..... Tibicina septendecim (L.)
Pickle worm (L) ..... Diaphania nitidalis Stoll.
Pigeon tremex (Hy) ..... Tremex columba L.
Pineapple scale (H) ..... Diaspis bromeliae (Kern.)
Pineapple weevil (C) ..... Metamasius ritchei Mar.
Pink boll worm (L) ..... Pectinophora gossypiella Saund.
Pistol case bearer (L) ..... Coleophora malivorella Riley
Plains false wireworm (C) ..... Eleodes opaca (Say)
Plum curculio (C) ..... Conotrachelus nenuphar (Hbst.)
Plum gouger (C) ..... Anthonomus scutellaris Lec.

Polyphemus moth (L) ..... Telea polyphemus Cram
Pomace fly (D) ..... Drosophila ampelophila Loew
Poplar borer (C) ..... Saperda calcarata Say
Potato aphid (H) ..... Illinoia solanifolii (Ashm.)
Potato flea beetle (C) ..... Epitrix cucumeris Harr.
Potato stalk borer (C) ..... Trichobaris trinotata (Say)
Potato tuber worm (L) ..... Phthorimaea operculella Zell.
Promethea moth (L) ..... Callosamia promethea Drury
Poultry bug (H) ..... Haematosiphon inodorus (Duges)
Purple scale (H) ..... Lepidosaphes becki Newm.
Putnam's scale (H) ..... Aspidiotus ancylus Putn.
Pyriform scale (H) ..... Pulvinaria pyriformis Ckll.

Quince curculio (C) ..... Conotrachelus crataegi Walsh

Raspberry cane borer (C) ..... Obérea bimaculata (Ol.)
Raspberry cane maggot (D) ..... Pegomyia rubivora Coq.
Raspberry leaf roller (L) ..... Exartema permundanum Clem.
Raspberry root borer (L) ..... Bembecia marginata Harr.
Raspberry sawfly (Hy) ..... Monophadnoides rubi (Harr.)
Red admiral (L) ..... Vanessa atlanta L.
Red-backed cutworm (L) ..... Euxoa ochrogaster Guen.
Red-banded thrips (T) ..... Selenothrips rubrocinctus (Giard)
Red-headed pine sawfly (Hy) ..... Neodiprion lecontei Fitch
Red-humped caterpillar (L) ..... Schizura concinna S. & A.
Red-legged flea beetle (C) ..... Crepidodera erythropus Melsh.
Red-legged grasshopper (O) ..... Melanoplus femur-rubrum DeG.
Red-legged ham beetle (C) ..... Necrobia rufipes (DeG.)
Red milkweed beetle (C) ..... Tetraopes tetraophthalmus (Forst.)
Red-shouldered ham beetle(C) ..... Necrobia ruficollis (Fab.)
Red turpentine beetle (C) ..... Dendroctonus valens Lec.
Red-winged pine beetle (C) ..... Dendroctonus rufipennis (Kirby)
Regal moth (L) ..... Citheronia regalis Fab.
Resplendent shield bearer (H) ..... Coptodisca splendoriferella Clem.
Rhododendron lacebug (H) ..... Stephanitis rhododendri Horv.
Rhubarb curculio (C) ..... Lixus concavus Say
Rice water weevil (C) ..... Lissorhoptrus simplex (Say)
Rice weevil (C) ..... Calendra oryzae (L.)
Ring-legged earwig (F) ..... Anisolabis annulipes Lucas
Rocky Mountain grasshopper (O) ..... Melanoplus spretus Uhl.
Rose chafer (C) ..... Macrodactylus subspinosus (Fab.)
Rose curculio (C) ..... Rhynchites bicolor Fab.
Rose midge (D) ..... Dasyneura rhodophaga Coq.
Rose sawfly (Hy) ..... Caliroa aethiops (Fab.)
Rose scale (H) ..... Aulacaspis rosae Bouché
Round-headed apple tree borer (C) ... Saperda candida Fab.
Round-headed pine beetle (C) ..... Dendroctonus convexifrons Hopk.
Rusty plum aphid (H) ..... Hysteroneura setariae (Thos.)
Rusty tussock moth (L) ..... Notolophus antiqua L.

Saddle-back caterpillar (L)..... Sibine stimulea Clem.
Saddled leafhopper (H)..... Thamnotettix clitellarius (Say)
Salt-marsh caterpillar (L)..... Estigmene acraea Drury
Sand wireworm (C)..... Horistonotus uhleri Horn
San Jose scale (H)..... Aspidiotus perniciosus Comst.
Saw-toothed grain beetle (C)..... Oryzaephilus surinamensis (L.)
Scaly-leg mite (A)..... Cnemidocoptes mutans Robin
Screw worm (D)..... Cochliomyia macellaria (Fab.)
Scurfy scale (H)..... Chionaspis furfura Fitch
Seedcorn maggot (D)..... Hylemyia cilicrura Rond.
Serpentine leaf miner (D)..... Agromyza pusilla Meig.
Sheep follicle mite (A)..... Demodex canis ovis Railliet
Sheep scab mite (A)..... Psoroptes ovis Her.
Sheep tick (D)..... Melophagus ovinus L.
Shot-hole borer (C)..... Scolytus rugulosus Ratz.
Silkworm (L)..... Bombyx mori L.
Silky ant (Hy)..... Formica fusca subsericea Say
Silky cane weevil (C)..... Metamasius sericeus Ol.
Sinuate pear tree borer (C)..... Agrilus sinuatus (Ol.)
Sitka-spruce beetle (C)..... Dendroctonus obesus (Mann.)
Six-spotted leafhopper (H)..... Cicadula 6-notata (Fall.)
Smaller Mexican pine beetle (C)..... Dendroctonus mexicanus Hopk.
Snowy tree cricket (O)..... Oecanthus niveus DeG.
Soft scale (H)..... Coccus hesperidum L.
Southern armyworm (L)..... Prodenia eridania Cram.
Southern beet webworm (C)..... Pachyzancla bipunctalis Fab.
Southern cabbage worm (L)..... Pieris protodice B. & L.
Southern corn stalk borer (L)..... Diatraea zeacolella Dyar
Southern cowpea weevil (C)..... Mylabris quadrimaculatus Fab.
Southern pine beetle (C)..... Dendroctonus frontalis Zimm.
Southern pine sawyer (C)..... Monochamus titillator (Fab.)
Southwestern pine beetle (C)..... Dendroctonus barberi Hopk.
Spined soldier bug (H)..... Podisus maculiventris (Say)
Spiny oak worm (L)..... Anisota stigma Fab.
Spotted asparagus beetle (C)..... Crioceris duodecimpunctata L.
Spotted blister beetle (C)..... Epicauta maculata (Say)
Spotted cucumber beetle (C)..... Diabrotica duodecimpunctata (Fab.)
Spotted cutworm (L)..... Agrotis c-nigrum L.
Spotted tussock moth (L)..... Halisidota maculata Harr.
Spring canker worm (L)..... Paleacrita vernata Peck
Spruce aphid (H)..... Aphis abietina Walk.
Spruce budworm (L)..... Harmologa fumiferana Clem.
Spruce sawfly (Hy)..... Neodiprion abietis (Harr.)
Squash beetle (C)..... Epilachna borealis (Fab.)
Squash borer (L)..... Melittia satyriniformis Hb.
Stable fly (D)..... Stomoxys calcitrans L.
Stalk borer (L)..... Papaipema nebris nitela Guen.
Strawberry crown borer (C)..... Tyloderma fragariae Riley

Strawberry crown moth (L).....Aegeria rutilans Hy. Edw.
Strawberry flea beetle (C).....Haltica ignita Ill.
Strawberry leaf roller (L).....Ancylis comptana Frŏhl.
Strawberry root worm (C).....Paria canella (Fab.)
Strawberry weevil (C).....Anthonomus signatus Say
Strawberry whitefly (H).....Trialeurodes packardi (Morrill)
Striped blister beetle (C).....Epicauta vittata Fab.
Striped cucumber beetle (C).....Diabrotica vittata (Fab.)
Striped cutworm (L).....Euxoa tessellata Harr.
Striped garden caterpillar (L).....Polia legitima Grote
Sugarcane beetle (C).....Euetheola rugiceps (Lec.)
Sugarcane borer (L).....Diatraea saccharalis Fab.
Sugar-maple borer (C).....Glycobius speciosus (Say)
Sweet-potato flea beetle (C).....Chaetocnema confinis Cr.
Sweet-potato leaf roller.....Pilocrocis tripunctata Fab.
Sweet-potato weevil (C).....Cylas formicarius Fab.

Tarnished plant bug (H).....Lygus pratensis (L.)
Terrapin scale (H).....Eulecanium nigrofasciatum Perg.
Thistle aphid (H).....Anuraphis cardui (L.)
Three-banded leafhopper (H).....Erythroneura tricincta Fitch
Three-lined potato beetle (C).....Lema trilineata (Ol.)
Tiger swallowtail (L).....Papilio glaucus L.
Toadbug (H).....Gelastocoris oculatus (Fab.)
Tobacco flea beetle (C).....Epitrix parvula (Fab.)
Tobacco worm (L).....Protoparce quinquemaculata Haw.
Tomato worm (L).....Protoparce sexta Johan.
Turkey gnat (D).....Simulium meridionale Riley
Turnip aphid (H).....Rhopalosiphum pseudobrassicae (Davis)
Twig girdler (C).....Oncideres cingulatus (Say)
Two-lined chestnut borer (C).....Agrilus bilineatus (Web.)
Two-striped grasshopper (O).....Melanoplus bivittatus Say
Two-striped walkingstick (O).....Anisomorpha buprestoides Stahl

Ugly-nest caterpillar (L).....Cacoecia cerasivorana Fitch
Unicorn caterpillar (L).....Schizura unicornis S. & A.

Vagabond crambus (L).....Crambus vulgivagellus Clem.
Variegated cutworm (L).....Lycophotia margaritosa saucia Hb.
Viceroy (L).....Basilarchia archippus Cram.

Walkingstick (O).....Diapheromera femorata Say
Walnut case bearer (L).....Mineola juglandis LeB.
Walnut caterpillar (L).....Datana integerrima G. & R.
Walnut scale (H).....Aspidiotus juglans-regiae Comst.
Walnut sphinx (L).....Cressonia juglandis S. & A.
Water-cress leaf beetle (C).....Phaedon aeruginosus Suffr.
Water-cress sowbug.....Mancasellus brachyurus Harger

Wax moth (L) ..... Galleria mellonella L.
Western grape root worm (C) ..... Adoxus obscurus (L.)
Western peach borer (L) ..... Aegeria opalescens Edw.
Western pine beetle (C) ..... Dendroctonus brevicomis Lec.
Western spotted cucumber beetle (C).. Diabrotica soror Lec.
Western tussock moth (L) ..... Hemerocampa vetusta Boisd.
West Indian cane weevil (C) ..... Metamasius hemipterus L.
West Indian fruit fly (D) ..... Anastrepha fraterculus Wied.
Wheat head armyworm (C) ..... Neleucania albilinea Hb.
Wheat midge (D) ..... Thecodiplosis mosellana Gehin (Contarinia tritici Kirby)
Wheat stem maggot (D) ..... Meromyza americana Fitch
Wheat straw worm (Hy) ..... Harmolita grandis Riley
Wheat wireworm (C) ..... Agriotes mancus (Say)
Wheel bug (H) ..... Arilus cristatus (L.)
White-lined sphinx (L) ..... Celerio lineata Fab.
White-marked spider beetle (C) ..... Ptinus fur L.
White-marked tussock moth (L) ..... Hemerocampa leucostigma S. & A.
White-pine weevil ..... Pissodes strobi (Peck.)
W-marked cutworm (L) ..... Agrotis unicolor Walk.
Woolly alder aphid (H) ..... Prociphilus tessellatus (Fitch)
Woolly apple aphid (H) ..... Eriosoma lanigerum (Hausm.)
Woolly whitefly (H) ..... Aleurothrixus howardi (Quaint.)

Yellow-fever mosquito (D) ..... Aedes aegypti L.
Yellow-headed fireworm (L) ..... Peronea minuta Rob.
Yellow meal worm (C) ..... Tenebrio molitor L.
Yellow-necked caterpillar (L) ..... Datana ministra Drury
Yellow-striped armyworm (L) ..... Prodenia ornithogalli Guen.
Yucca moth (L) ..... Tegeticula alba Zell.

Zebra caterpillar (L) ..... Mamestra picta Harr.

Insects Listed by Scientific Names

Acronycta americana Harr ..... American dagger moth
Acrosternum hilaris (Say) ..... Green stinkbug
Adoxus obscurus (L.) ..... Western grape root worm
Aedes aegypti L ..... Yellow-fever mosquito
Aegeria exitiosa Say ..... Peach borer
Aegeria opalescens Edw. ..... Western peach borer
Aegeria rutilans Hy. Edw. ..... Strawberry crown moth
Aglais antiopa L ..... Mourning-cloak butterfly
Agrilus anxius Gory ..... Bronze birch borer
Agrilus bilineatus (Web.) ..... Two-lined chestnut borer
Agrilus sinuatus (Ol.) ..... Sinuate pear tree borer
Agriotes mancus (Say) ..... Wheat wireworm
Agromyza parvicornis Loew ..... Corn blotch leaf miner
Agromyza pusilla Meigen ..... Serpentine leaf miner

Agromyza simplex Loew.....Asparagus miner
Agrotis c-nigrum L.....Spotted cutworm
Agrotis unicolor Walk.....W-marked cutworm
Agrotis ypsilon Rott.....Black cutworm
Alaus oculatus (L.).....Eyed click beetle
Aleurocanthus woglumi Ashby.....Citrus blackfly
Aleurothrixus howardii (Quaint.) ...Woolly whitefly
Alsophila pometaria Harr.....Fall canker worm
Alypia octomaculata Fab.....Eight-spotted forester
Ampeloglypter sesostris (Lec.).....Grape cane gall maker
Amphicerus bicaudatus (Say).....Apple twig borer
Anarsia lineatella Zell.....Peach twig borer
Anastrepha fraterculus Wied.....West Indian fruit fly
Ancylis comptana Frohl.....Strawberry leaf roller
Anisolabis annulipes Lucas.....Ring-legged earwig
Anisomorpha buprestoides Stahl.....Two-striped walkingstick
Anisota senatoria S. & A.....Orange-striped oak worm
Anisota stigma Fab.....Spiny oak worm
Anthonomus grandis Boh.....Boll weevil
Anthonomus scutellaris Lec.....Plum gouger
Anthonomus signatus Say.....Strawberry weevil
Anthrenus scrophulariae (L.) Carpet beetle
Anuraphis bakeri (Cowan).....Clover aphid
Anuraphis cardui (L.).....Thistle aphid
Anuraphis maidi-radicis (Forbes).....Corn root aphid
Anuraphis persicae-niger (Smith).....Black peach aphid
Aonidiella aurantii Mask.....Orange scale
Aphanothrips obscurus (Mull.) .....Grass thrips
Aphis abietina Walk.....Spruce aphid
Aphis gossypii Glover.....Cotton aphid, Melon aphid
Aphis illinoisense Shimer.....Grape vine aphid
Aphis pomi DeG.....Apple aphid
Apis mellifera L.....Honey bee
Araecerus fasciculatus (DeG.).....Coffee-bean weevil
Archips argyrospila Walk.....Fruit tree leaf roller
Argyresthia thuiella Pack.....Arborvitae leaf miner
Arilus cristatus (L.).....Wheel bug
Aspidiotus ancylus Putn.....Putnam's scale
Aspidiotus forbesi Johns.....Cherry scale
Aspidiotus howardi Ckll.....Howard's scale
Aspidiotus juglans-regiae Comst.....Walnut scale
Aspidiotus ostreaeformis Curt.....European fruit scale
Aspidiotus perniciosus Comst.....San Jose scale
Aspidiotus rapax Comst.....Greedy scale
Aspidiotus uvae Comst.....Grape scale
Attagenus piceus Ol.....Black carpet beetle
Aulacaspis rosae Bouché.....Rose scale
Autographa brassicae Riley.....Cabbage looper

Autographa californica Spey . . . . . Alfalfa looper
Autographa falcifera Kirby. . . . . Celery looper
Automeris io Fab . . . . . Io moth

Balaninus caryae Horn . . . . . Pecan weevil
Balaninus proboscideus (Fab.). . . . . Large chestnut weevil
Balaninus rectus Say. . . . . Chestnut weevil
Basilarchia archippus Cram . . . . . Viceroy
Basilona imperialis Drury . . . . . Imperial moth
Bembecia marginata Harr . . . . . Raspberry root borer
Blatella germanica (L) . . . . . German cockroach
Blatta orientalis (L) . . . . . Oriental cockroach
Blissus leucopterus (Say) . . . . . Chinch bug
Bombyx mori L . . . . . Silkworm
Boophilus annulatus Say . . . . . Cattle tick
Brachystola magna Gir . . . . . Lubber grasshopper
Brevicoryne brassicae (L.) . . . . . Cabbage aphid
Bruchophagus funebris Howard . . . . . Clover seed chalcid
Bryobia praetiosa Koch . . . . . Clover mite

Cacoecia cerasivorana Fitch . . . . . Ugly-nest caterpillar
Calendra granaria (L.) . . . . . Granary weevil
Calendra oryzae (L.) . . . . . Rice weevil
Caliroa aethiops (Fab.) . . . . . Rose sawfly
Callosamia promethea Drury . . . . . Promethea moth
Carpocapsa pomonella L . . . . . Codling moth
Celerio lineata Fab . . . . . White-lined sphinx
Ceratitis capitata Wied. . . . . Mediterranean fruit fly
Ceratomia catalpae Boisd . . . . . Catalpa sphinx
Ceresa bubalus (Fab.) . . . . . Buffalo treehopper
Ceroplastes cirripediformis Comst . . . . Barnacle scale
Ceroplastes floridensis Comst . . . . . Florida wax scale
Cerotoma trifurcata (Forst.) . . . . . Bean leaf beetle
Ceutorhynchus quadridens (Panz.). . . . Cabbage seed-stalk curculio
Ceutorhynchus rapae Gyll . . . . . Cabbage curculio
Chaetocnema confinis Cr . . . . . Sweet-potato flea beetle
Chelymorpha cassidea (Fab.). . . . . Argus tortoise beetle
Chionaspis euonymi Comst . . . . . Euonymus scale
Chionaspis furfura Fitch . . . . . Scurfy scale
Chirida guttata (Ol.). . . . . Mottled tortoise beetle
Chorizagrotis auxiliaris Grote . . . . . Army cutworm
Chrysobothris femorata (Ol.). . . . . Flat-headed apple tree borer
Chrysobothris tranquebarica (Gmel.) . . Australian-pine borer
Chrysomphalus aurantii Mask. . . . . California red scale
Chrysomphalus ficus Ashm . . . . . Florida red scale
Chrysomphalus obscurus Comst . . . . . Obscure scale
Chrysomphalus tenebricosus (Comst.) . Gloomy scale
Chrysop spp . . . . . Deer flies

Cicada spp.....Cicada
Cicadula 6-notata (Fall).....Six-spotted leafhopper
Cimbex americana Leach.....Elm sawfly
Cimex lectularius L.....Bedbug
Cingilia catenaria Drury.....Chain-spotted geometer
Cirphis unipuncta (Haw.).....Armyworm
Citheronia regalis Fab.....Hickory horned devil, Regal moth
Cladius isomerus Norton.....Bristly rose slug
Cleora pampinaria Guen.....Cranberry spanworm
Cnemidocoptes mutans Robin.....Scaly-leg mite
Cnidocampa flavescens Walk.....Oriental moth
Coccus hesperidum L.....Soft scale
Cochliomyia macellaria (Fab.).....Screw worm
Colaspis brunnea (Fab.).....Grape colaspis
Coleophora fletcherella Fern.....Cigar case bearer
Coleophora laricella Hb.....Larch case bearer
Coleophora limosipennella Dup.....Elm case bearer
Coleophora malivorella Riley.....Pistol case bearer
Conotrachelus crataegi Walsh.....Quince curculio
Conotrachelus nenuphar (Hbst.).....Plum curculio
Contarinia johnsoni Sling.....Grape blossom midge
Contarinia pyrivora Riley.....Pear midge
Coptodisca splendoriferella Clem.....Resplendent shield bearer
Corydalis cornuta L.....Helgramite, Dobson fly
Cosmopolites sordidus Germ.....Banana root borer
Cotinis nitida (L.).....Green June beetle
Crambus hortuellus Hb.....Cranberry girdler
Crambus vulgivagellus Clem.....Vagabond crambus
Craponius inaequalis (Say).....Grape curculio
Crepidodera erythropus Melsh.....Red-legged flea beetle
Cressonia juglandis S. & A.....Walnut sphinx
Crioceris asparagi (L.).....Asparagus beetle
Crioceris duodecimpunctata L.....Spotted asparagus beetle
Cryptothrips floridensis Watson.....Camphor thrips
Cylas formicarius Fab.....Sweet-potato weevil
Cyllene robiniae (Forst.).....Hickory borer, Locust borer

Danaus archippus Fab.....Monarch butterfly
Dasyneura rhodophaga Coq.....Rose midge
Dasyneura trifolii Loew.....Clover leaf midge
Datana integerrima G. & R.....Walnut caterpillar
Datana ministra Drury.....Yellow-necked caterpillar
Demodex bovis Stiles.....Cattle follicle mite
Demodex canis Leydig.....Dog follicle mite
Demodex canis ovis Railliet.....Sheep follicle mite
Demodex capri Railliet.....Goat follicle mite
Demodex cati Megnin.....Cat follicle mite
Demodex equi Railliet.....Horse follicle mite

Demodex phylloides Csokor.....Hog follicle mite
Dendroctonus approximatus Dz.....Colorado pine beetle
Dendroctonus arizonicus Hopk.....Arizona pine beetle
Dendroctonus barberi Hopk.....Southwestern pine beetle
Dendroctonus borealis Hopk.....Alaska spruce beetle
Dendroctonus brevicomis Lec.....Western pine beetle
Dendroctonus convexifrons Hopk.....Round-headed pine beetle
Dendroctonus engelmanni Hopk.....Engelmann-spruce beetle
Dendroctonus frontalis Zimm.....Southern pine beetle
Dendroctonus jeffreyi Hopk.....Jeffrey-pine beetle
Dendroctonus mexicanus Hopk.....Smaller Mexican pine beetle
Dendroctonus micans Kug.....European spruce beetle
Dendroctonus monticolae Hopk.....Mountain pine beetle
Dendroctonus murrayanae Hopk.....Lodgepole-pine beetle
Dendroctonus obesus (Mann.).....Sitka-spruce beetle
Dendroctonus parallelocollis Chap....Larger Mexican pine beetle
Dendroctonus piceaperda Hopk.....Eastern spruce beetle
Dendroctonus ponderosae Hopk.....Black Hills beetle
Dendroctonus pseudotsugae Hopk....Douglas-fir beetle
Dendroctonus punctatus Lec.....Allegheny spruce beetle
Dendroctonus rufipennis (Kirby).....Red-winged pine beetle
Dendroctonus simplex Lec.....Eastern larch beetle
Dendroctonus terebrans (Ol.).....Black turpentine beetle
Dendroctonus valens Lec.....Red turpentine beetle
Depressaria heracliana DeG.....Parsnip webworm
Dermestes lardarius L.....Larder beetle
Dermestes vulpinus Fab.....Hide beetle
Desmia funeralis Hb.....Grape leaf folder
Diabrotica duodecimpunctata (Fab.)..Spotted cucumber beetle
Diabrotica longicornis (Say).....Corn root worm
Diabrotica soror Lec.....Western spotted cucumber beetle
Diabrotica vittata (Fab.).....Striped cucumber beetle
Dialeurodes citri (Ashm.).....Citrus whitefly
Dialurodes citrifolii (Morg.).....Cloudy-winged whitefly
Diaphania hyalinata L.....Melon worm
Diaphania nitidalis Stoll.....Pickle worm
Diapheromera femorata Say.....Walkingstick
Diarthronomyia hypogaea Loew.....Chrysanthemum gall midge
Diaspis bromeliae Kein.....Pineapple scale
Diaspis echinocacti (Bouché).....Cactus scale
Diatraea saccharalis Fab.....Sugarcane borer
Diatraea zeacolella Dyar.....Southern corn stalk borer
Dichomeris ligulella Hb.....Palmer worm
Diestrammena japonica Blatch.....Greenhouse stone cricket
Diprion simile (Hartig).....Introduced pine sawfly
Dissosteira carolina (L.).....Carolina grasshopper
Drosophila ampelophila Loew.....Pomace fly
Dysdercus suturellus (H.-Sch.).....Cotton stainer

Elasmopalpus lignosellus Zell. . . . . Lesser corn stalk borer
Eleodes opaca (Say) . . . . . Plains false wireworm
Empoasca mali LeB . . . . . Apple leafhopper
Ennomos subsignarius Hbn . . . . . Elm spanworm
Ephestia kuehniella Zell . . . . . Mediterranean flour moth
Epicaerus imbricatus Say . . . . . Imbricated snout beetle
Epicauta cinerea (Forst.) . . . . . Gray blister beetle
Epicauta cinerea marginata (Fab.) . . . . Margined blister beetle
Epicauta maculata (Say) . . . . . Spotted blister beetle
Epicauta pennsylvanica (DeG.) . . . . . Black blister beetle
Epicauta vittata Fab. . . . . Striped blister beetle
Epicnaptera americana Harr . . . . . Lappet moth
Epilachna borealis (Fab.) . . . . . Squash beetle
Epilachna corrupta Muls . . . . . Mexican bean beetle
Epitrix cucumeris Harr . . . . . Potato flea beetle
Epitrix parvula (Fab.) . . . . . Tobacco flea beetle
Epochra canadensis Loew . . . . . Currant fruit fly
Erannis tiliaria Harr . . . . . Lime-tree looper
Eriocampoides limacina Retz. . . . . Pear slug
Eriophyes oleivorus Ashm. . . . . Citrus rust mite
Eriophyes pyri Pagnst. . . . . Pear leaf blister mite
Eriosoma lanigerum (Hausm.) . . . . . Woolly apple aphid
Erythraspides pygmaea (Say) . . . . . Grape sawfly
Erythroneura comes (Say) . . . . . Grape leafhopper
Erythroneura tricincta Fitch . . . . . Three-banded leafhopper
Estigmene acraea Drury. . . . . Salt-marsh caterpillar
Euetheola rugiceps (Lec.) . . . . . Sugarcane beetle
Eulecanium nigrofasciatum Perg. . . . . Terrapin scale
Euproctis chrysorrhoea L . . . . . Brown-tail moth
Eurymus eurytheme Boisd. . . . . Alfalfa caterpillar
Eutettix tenellus (Baker) . . . . . Beet leafhopper
Euxoa messoria Harr. . . . . Dark-sided cutworm
Euxoa ochrogaster Guen. . . . . Red-backed cutworm
Euxoa tessellata Harr . . . . . Striped cutworm
Evergestis rimosalis Guen. . . . . Cross-striped cabbage worm
Evoxysoma vitis Saunders . . . . . Grape seed chalcid
Exartema permundanum Clem . . . . . Raspberry leaf roller

Feltia annexa Treit . . . . . Granulate cutworm
Feltia subgothica Haw. . . . . Dingy cutworm
Fidia viticida Walsh . . . . . Grape root worm
Formica fusca subsericea Say. . . . . Silky ant
Frankliniella tritici (Fitch) . . . . . Flower thrips

Galerucella xanthomelaena (Schrank) . . Elm leaf beetle
Galleria mellonella L . . . . . Wax moth
Gastrophilus intestinalis DeG . . . . . Horse botfly
Gelastocoris oculatus (Fab.) . . . . . Toadbug

Glycobius speciosus (Say).....Sugar-maple borer
Goniurus proteus L.....Bean leaf roller
Gossyparia spuria Modeer.....European elm scale
Graptolitha antennata Walk.....Green fruit worm
Gryllotalpa hexadactyla Perty.....Northern mole cricket
Gryllus assimilis Fab.....Field cricket
Gryllus domesticus L.....House cricket
Gynaikothrips uzeli Zimm.....Cuban-laurel thrips

Haematobia irritans L.....Horn fly
Haematopinus suis L.....Hog louse
Haematosiphon inodorus (Duges).....Poultry bug
Halisidota caryae Harr.....Hickory tussock moth
Halisidota maculata Harr.....Spotted tussock moth
Halisidota tessellaris S. & A.....Pale tussock moth
Haltica chalybea Ill.....Grape flea beetle
Haltica ignita Ill.....Strawberry flea beetle
Harmolita grandis Riley.....Wheat straw worm
Harmologa fumiferana Clem.....Spruce budworm
Harrisina americana Guer.....Grape leaf skeletonizer
Heliothis obsoleta Fab.....Corn ear worm, Boll worm
Heliothrips haemorrhoidalis Bouché...Greenhouse thrips
Hellula undalis Fab.....Cabbage webworm
Hemerocampa leucostigma S. & A....White-marked tussock moth
Hemerocampa vetusta Boisd.....Western tussock moth
Hemichionaspis aspidistrae Sign.....Fern scale
Hemileuca maia Drury.....Buck moth
Horistonotus uhlerii Horn.....Sand wireworm
Howardia biclavis Comst.....Mining scale
Hyalopterus arundinis (Fab.).....Mealy plum aphid
Hylastinus obscurus (Marsham).....Clover root borer
Hylemyia antiqua Meig.....Onion maggot
Hylemyia brassicae (Bouché).....Cabbage maggot
Hylemyia cilicrura Rond.....Seed-corn maggot
Hypena humuli Harr.....Hop looper
Hypera punctata(Fab.).....Clover leaf weevil
Hyphantria cunea Drury.....Fall webworm
Hypothenemus hispidulus (Lec.).....Apple twig beetle
Hypsopygia costalis Fab.....Clover hay worm
Hysteroneura setariae (Thos.).....Rusty plum aphid

Icerya purchasi Mask.....Cottony-cushion scale
Illinoia pisi (Kalt.).....Pea aphid
Illinoia solanifolii (Ashm.).....Potato aphid
Iridomyrmex humilis Mayr.....Argentine ant
Ischnaspis longirostris Sign.....Black thread scale
Itame ribearia Fitch.....Currant spanworm
Ithycerus noveboracensis (Forst.).....New York weevil

Janus integer Norton.....Currant stem girdler
Jonthonota nigripes (Ol.).....Black-legged tortoise beetle

Kaliosysphinga ulmi Sund.....Elm leaf miner

Languria mozardi Latr.....Clover stem borer
Laphygma exigua Hbn.....Beet armyworm
Laphygma frugiperda S. & A.....Fall armyworm
Lasioderma serricorne (Fab.).....Cigarette beetle
Laspeyresia interstinctana Clem.....Clover head caterpillar
Laspeyresia nigricana Steph.....Pea moth
Laspeyresia prunivora Walsh.....Lesser apple worm
Lecanium persicae Fab.....European peach scale
Lecanium prunastri Fonsc.....Globose scale
Lema trilineata (Ol.).....Three-lined potato beetle
Lepidosaphes becki Newm.....Purple scale
Lepidosaphes gloveri Pack.....Glover's scale
Lepidosaphes ulmi L.....Oyster-shell scale
Leptinotarsa decemlineata (Say).....Colorado potato beetle
Leptinotarsa juncta (Germ.).....False potato beetle
Leptocoris trivittatus (Say).....Boxelder bug
Leptoglossus phyllopus (L.).....Leaf-footed bug
Lethocerus americanus Comst.....Giant water bug
Ligyrus gibbosus (DeG.).....Carrot beetle
Lissorhoptrus simplex (Say).....Rice water weevil
Lixus concavus Say.....Rhubarb curculio
Loxostege similalis Guen.....Garden webworm
Loxostege sticticalis L.....Beet webworm
Lucanus elaphus Fab.....Giant stag beetle
Lycophotia margaritosa saucia Hb....Variegated cutworm
Lygus communis Knight.....Pear plant bug
Lygus pratensis (L.).....Tarnished plant bug

Macrobasis unicolor (Kirby).....Ash-gray blister beetle
Macrodactylus subspinosus (Fab.)....Rose chafer
Macronoctua onusta Grote.....Iris borer
Macrosiphum granarium (Kirby).....English grain aphid
Malacosoma americana Fab.....Eastern tent caterpillar
Malacosoma disstria Hb.....Forest tent caterpillar
Mamestra picta Harr.....Zebra caterpillar
Mancasellus brachyurus Harger.....Water-cress sowbug
Melanoplus bivittatus Say.....Two-striped grasshopper
Melanoplus devastator Scudd.....Devastating grasshopper
Melanoplus differentialis Thomas.....Differential grasshopper
Melanoplus femur-rubrum DeG.....Red-legged grasshopper
Melanoplus spretus Uhl.....Rocky Mountain grasshopper
Melittia satyriniformis Hb.....Squash borer
Melophagus ovinus L.....Sheep tick

Merodon equestris Fab.....Narcissus bulb fly
Meromyza americana Fitch.....Wheat stem maggot
Metamasius hemipterus L.....West Indian cane weevil
Metamasius ritchei Mar.....Pineapple weevil
Metamasius sericeus Ol.....Silky cane weevil
Metriona bicolor (Fab.).....Golden tortoise beetle
Microcentrum retinerve Burm.....Angular-winged katydid
Mineola indigenella Zell.....Leaf crumpler
Mineola indigenella nebulella Riley....Pecan case bearer
Mineola juglandis LeB.....Walnut case bearer
Mineola vaccinii Riley.....Cranberry fruit worm
Miris dolabratus (L.).....Meadow plant bug
Monarthropalpus buxi Labou.....Boxwood leaf miner
Monochamus titillator (Fab.).....Southern pine sawyer
Monophadnoides rubi (Harr.).....Raspberry sawfly
Monoxia puncticollis (Say).....Beet leaf beetle
Murgantia histrionica Hahn.....Harlequin bug
Musca domestica L.....House fly
Mylabris chinensis (L.).....Cowpea weevil
Mylabris obtectus (Say).....Bean weevil
Mylabris pisorum (L.).....Pea weevil
Mylabris quadrimaculatus Fab.....Southern cowpea weevil
Mylabris rufimanus Boh.....Broad-bean weevil
Myzus cerasi (Fab.).....Black cherry aphid
Myzus houghtonensis (Troup).....Gooseberry witch-broom aphid
Myzus persicae (Sulz.).....Green peach aphid
Myzus ribis (L.).....Currant aphid

Napomyza chrysanthemi Kowarz.....Chrysanthemum leaf miner
Necrobia ruficollis (Fab.).....Red-shouldered ham beetle
Necrobia rufipes (DeG.).....Red-legged ham beetle
Neleucania albilinea Hb.....Wheat head armyworm
Nematus erichsoni Hartig.....Larch sawfly
Neodiprion abietis (Harr.).....Spruce sawfly
Neodiprion lecontei Fitch.....Red-headed pine sawfly
Neolecanium cornuparvum Thro.....Magnolia scale
Nephelodes emmedonia Cram.....Bronzed cutworm
Notolophus antiqua L.....Rusty tussock moth
Nysius ericae (Schill.).....False chinch bug

Oberea bimaculata (Ol.).....Raspberry cane borer
Oecanthus nigricornis Walk.....Black-horned tree cricket
Oecanthus nigricornis quadripunctatus
Beut.....Four-spotted tree cricket
Oecanthus niveus DeG.....Snowy tree cricket
Oncideres cingulatus (Say).....Twig girdler
Oryzaephilus surinamensis (L.).....Saw-toothed grain beetle
Oxyptilus periscelidactylus Fitch.....Grape plume moth

Pachyzancla bipunctalis Fab.....Southern beet webworm
Paleacrita vernata Peck.....Spring canker worm
Pantomorus fulleri (Horn).....Fuller's rose beetle
Papaipema nebris nitela Guen.....Stalk borer
Papilio glaucus L.....Tiger swallowtail
Papilio polyxenes Fab.....Black swallowtail, Parsley worm, Celery worm
Papilio thoas L.....Orange dog
Paranthrene polistiformis (Harr.).....Grape root borer
Paria canella (Fab.).....Strawberry root worm
Parlatoria pergandei Comst.....Chaff scale
Pectinophora gossypiella Saund.....Pink boll worm
Pediculus humanus L.....Head louse
Pediculus vestimenti Nitz.....Body louse
Pegomyia rubivora Coq.....Raspberry cane maggot
Peranabrus scabricollis Thoms.....Coulee cricket
Periphyllus negundinis (Thomas).....Boxelder aphid
Periplaneta americana L.....American cockroach
Periplaneta australasiae Fab.....Australian cockroach
Peronea minuta Rob.....Yellow-headed fireworm
Phaedon aeruginosus Suffr.....Water-cress leaf beetle
Philaenus lineatus (L).....Lined spittle bug
Phlyctaenia ferrugalis Hb.....Greenhouse leaf tyer
Phobetron pithecium S. & A.....Hag moth
Pholus achemon Drury.....Achemon sphinx
Phorodon humuli (Schrank).....Hop aphid
Phryganidia californica Pack.....California oak worm
Phthorimaea operculella Zell.....Potato tuber worm
Phthorophloeus liminaris (Harr.).....Peach bark beetle
Phyllotreta armoraciae (Koch.).....Horse-radish flea beetle
Phylloxera vitifoliae (Fitch).....Grape phylloxera
Phytonomus posticus (Gyll.).....Alfalfa weevil
Phytophaga destructor (Say).....Hessian fly
Pieris protodice B. & L.....Southern cabbage worm
Pieris rapae L.....Imported cabbage worm
Pilocrocis tripunctata Fab.....Sweet-potato leaf roller
Piophila casei L.....Cheese skipper
Pissodes strobi (Peck.).....White-pine weevil
Plathypena scabra Fab.....Green clover worm
Plodia interpunctella Hb.....Indian-meal moth
Plutella maculipennis Curt.....Diamond-back moth
Podisus maculiventris (Say).....Spined soldier bug
Podosesia syringae Harr.....Lilac borer
Poecilocapsus lineatus (Fab.).....Four-lined plant bug
Polia legitima Grote.....Striped garden caterpillar
Polia renigera Steph.....Bristly cutworm
Pollenia rudis Fab.....Cluster fly

Polychrosis viteana Clem.....Grape berry moth
Porthetria dispar L.....Gypsy moth
Prenolepis longicornis Latr.....Crazy ant
Prionoxystus robiniae Peck.....Carpenter worm
Prociphilus tessellatus (Fitch).....Woolly alder aphid
Prodenia eridania Cram.....Southern armyworm
Prodenia ornithogalli Guen.....Yellow-striped armyworm
Protoparce quinquemaculata Haw....Tobacco worm
Protoparce sexta Johan.....Tomato worm
Pseudococcus citri Risso.....Citrus mealybug
Pseudococcus nipae Mask.....Cocoanut mealybug
Psila rosae Fab.....Carrot rust fly
Psoroptes ovis Her.....Sheep scab mite
Psorosina hammondi (Riley).....Apple leaf skeletonizer
Psylla pyri L.....Pear psylla
Psylliodes punctulata Melsh.....Hop flea beetle
Pteronidea ribesii (Scop.).....Imported currant worm
Ptinus brunneus Dufts.....Brown spider beetle
Ptinus fur L.....White-marked spider beetle
Pulvinaria innumerabilis Rathv.....Cottony maple scale
Pulvinaria psidii Mask.....Green shield scale
Pulvinaria pyriformis Ckll.....Pyriform scale
Pyralis farinalis L.....Meal moth

Reduvius personatus (L).....Masked hunter
Rhagoletis cingulata Loew.....Cherry fruit fly, Cherry maggot
Rhagoletis pomonella Walsh.....Blueberry maggot, Apple maggot
Rhopalosiphum prunifoliae (Fitch)....Apple grain aphid
Rhopalosiphum pseudobrassicae (Davis).....Turnip aphid
Rhopobota naevana Hb.....Black-headed fireworm
Rhynchites bicolor Fab.....Rose curculio

Saissetia hemisphaerica Targ.....Hemispherical scale
Saissetia oleae Bern.....Black scale
Samia cecropia L.....Cecropia moth
Saperda calcarata Say.....Poplar borer
Saperda candida Fab.....Round-headed apple tree borer
Saperda tridentata Ol.....Elm borer
Saperda vestita Say.....Linden borer
Scapteriscus vicinus Scud .....Changa
Schizura concinna S. & A.....Red-humped caterpillar
Schizura unicornis S. & A.....Unicorn caterpillar
Scirtothrips citri Moulton.....Orange thrips
Scolytus quadrispinosus Say.....Hickory bark beetle
Scolytus rugulosus Ratz.....Shot-hole borer

Scotogramma trifolii Rott.....Clover cutworm
Selenothrips rubrocinctus (Giard).....Red-banded thrips
Sibine stimulea Clem.....Saddle-back caterpillar
Sidemia devastator Brace.....Glassy cutworm
Simulium meridionale Riley.....Turkey gnat
Sitodrepa panicea (L.).....Drug-store weevil
Sitotroga cerealella Ol.....Angoumois grain moth
Solenopsis geminata Fab.....Fire ant
Sphenophorus spp.....Corn billbugs
Spilonota ocellana Shiff.....Eye-spotted budmoth
Stagmomantis carolina Johan.....Carolina mantis
Stephanitis rhododendri Horv.....Rhododendron lacebug
Sternochestus mangifera Fab.....Mango seed weevil
Stomoxys calcitrans L.....Stable fly
Synanthedon tipuliformis L.....Currant borer
Syntomaspis druparum (Boh).....Apple seed chalcid
Systena taeniata (Say).....Banded flea beetle
Systena taeniata blanda (Melsh.).....Pale-striped flea beetle

Tabanus atratus Fab.....Black horsefly
Tachypterellus quadrigibbus (Say).....Apple curculio
Taeniothrips inconsequens Uzel.....Pear thrips
Tarsonemus pallidus Banks.....Cyclamen mite
Tegeticula alba Zell.....Yucca moth
Telea polyphemus Cram.....Polyphemus moth
Tenebrio molitor L.....Yellow meal worm
Tenebrio obscurus Fab.....Dark meal worm
Tenebroides mauritanicus (L.).....Cadelle
Tenodera sinensis (Sauss.).....Chinese mantis
Tetraleurodes mori (Quaint.).....Mulberry whitefly
Tetramorium caespitum L.....Pavement ant
Tetraopes tetraophthalmus (Forst.).....Red milkweed beetle
Thamnotettix clitellarius (Say).....Saddled leafhopper
Thecodiplosis mosellana Gehin (Contarinia tritici Kirby).....Wheat midge
Thrips tabaci L.....Onion thrips
Thyreocoris pulicarius (Germ.).....Negrobug
Thyridopteryx ephemeraeformis Haw..Bagworm
Tibicina septendecim (L.).....Periodical cicada
Tinea pellionella L.....Case-bearing clothes moth
Tischeria malifoliella Clem.....Apple leaf trumpet miner
Toxotrypana curvicauda Gers.....Papaya fruit fly
Tremex columba L.....Pigeon tremex
Trialeurodes packardi (Morrill).....Strawberry whitefly
Trialeurodes vaporariorum (Westw.)..Greenhouse whitefly
Triatoma sanguisuga (Lec.).....Blood-sucking conenose
Tribolium spp.....Flour beetle
Trichobaris trinotata (Say).....Potato stalk borer

Trichophaga tapetzella L. . . . . Carpet moth
Troctes divinatoria Mull . . . . . Booklouse
Tropaea luna L. . . . . Luna moth
Trypeta ludens Loew. . . . . Orange maggot
Tunga penetrans (L.) . . . . . Chigoe
Tyloderma fragariae Riley . . . . . Strawberry crown borer

Vanessa atlanta L. . . . . Red admiral
Vanessa virginiensis Drury. . . . . Painted beauty
Vespa maculata L. . . . . Bald-face hornet

Xylotrechus aceris Fisher . . . . . Gall-making maple borer

Zeuzera pyrina L. . . . . Leopard moth
Zophodia grossulariae Riley . . . . . Gooseberry fruit worm

Scientific Notes

Cold Process Oil Emulsions. While we realize that the use of Kaolin, glue and skimmed milk powders as emulsifiers is not new to science, it may be that these have not as yet been used by entomologists as emulsifiers for lubricating oils.

Kaolin—After considerable experimental work, the following formula proved to be the most practical:

Lubricating oil	gallons	2
Water	gallons	1
Kaolin	pounds	2⅔

Procedure: Add the Kaolin to the water and let it dissolve without stirring. Add the oil and pump 2 times with a bucket pump. An article has been approved for publication in the Journal of Agricultural Research dealing with Kaolin as an emulsifier.

This emulsion will mix with any water and any dilution of lime-sulphur solution.

Ground Glue—Glue has been used for several years as a stabilizer with soap emulsions to render them so that they could be used with hard waters and lime-sulphur solution. Only recently, however, we found that it could be used alone. The resulting emulsion is superior perhaps to the soap and glue formula. Twelve ounces of glue were insufficient and twenty-four ounces were too much—the emulsion being too thick. One pound was about right for the best results.

The following is the formula:

Lubricating oil	gallons	2
Water	gallons	1
Ground glue	pounds	1

Procedure: Dissolve the glue by soaking 10 or 12 hours in the water or heating; add the oil and pump 3 times. This formula is very easily made and promises much for those fruit growers who desire to make their own emulsion. It will mix with lime-sulphur solution and deep well water or so called hard water. It will probably ferment in a few days after being made.

Skimmed Milk Powders—

Lubricating oil	gallons	2
Water	gallons	1
Skimmed milk powder	ounces	14 to 16

Procedure: Add the skimmed milk powder to the water slowly, beating the mixture vigorously; add the oil and pump 3 times. This will mix with lime-sulphur solution and no doubt with most hard water. This formula is very easily made and from this standpoint should interest growers. We found it much easier to make than when calcium caseinate was used. No doubt it will ferment in a short time after being made.

We believe that one or all of these formulae will interest entomologists because of the ease with which they are made and also because of the certainty of the article after it is finished.

W. W. YOTHERS, *Orlando, Fla.*

Laboratory Experiments Relating to Codling Moth Control. During the past few years the writer has performed various kinds of experiments with freshly hatched codling moth larvae, under laboratory conditions, for the purpose of securing more accurate information on the use of arsenical materials in controlling this pest. The method of experimentation consists essentially in transferring freshly hatched larvae to apples that have been sprayed uniformly with an atomizer in the laboratory. The efficacy of lead arsenate in protecting apples against injury, the effectiveness of different types of spray coverage and of different concentrations of lead arsenate in the spray, and the manner in which the larvae become poisoned, are some of the questions involved. It is expected that a complete report on the investigations will appear later this year.

Four points in the results were somewhat surprising. First, with lead arsenate used 2 lbs.-100 gallons over 30 per cent. of the larvae entered the apples without being killed, even when the spray covering was as nearly perfect as could be made. About 15 per cent. of the larvae made stings, so that practically 50 per cent. of the larvae succeeded in producing injury. Second, the mist type of spray coverage showed by far the lowest effectiveness of any. Third, the film or spreader coverage gave scarcely any improvement in protection, as compared with the coverage of large drops or deposits which is obtained when no spreader is used. By increasing the proportion of lead arsenate and thus increasing the thickness of the film, the film coverage gave superior control, as would be expected. Fourth, increasing the proportion of lead arsenate resulted in decidedly and consistently reducing the amount of injury. These results would indicate that lead arsenate, especially in later cover sprays, does not have anyway near the efficacy of protecting apples from injury that has been generally believed. Certain technical tests in the orchard agree in results with the laboratory experiments.

R. H. SMITH

An Improved Insect Net. In practical use the ordinary insect net has the following defects: It closes up when the effort is made to place it over an insect; it drags on the ground in sweeping, killing or otherwise injuring the specimens; it twists up or closes in sweeping, shutting off the main part of the net so that fewer insects are taken; and it wears out rapidly by dragging on the ground and catching on stubs of weeds. The author has found that the following attachment eliminates a great many of these defects.

Description.—The ordinary insect net is used, with the handle about four feet long, or to suit one's convenience, with a small piece of heavy canvas sewed to the

closed end of the net in the form of a loop. Number 9 wire is then bent in the form of a hook and attached to the canvas loop. The wire is bent down to the handle and looped around it, about 8 to 10 inches from the net, leaving sufficient wire to hold the net out straight. The wire is then run along the handle and two more loops are

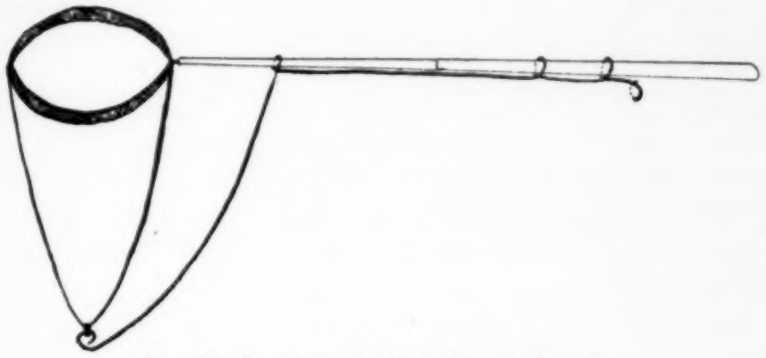

Fig. 12.—Insert net showing wire attachment.

twisted around the handle about 6 inches apart. An eye is made large enough for the thumb and bent downward. The net is now ready for use. The accompanying figure shows in detail the method of attaching wire and the position of the net.

In using the net, insert thumb in the eye of the wire, grasping the handle, then by turning the thumb from left to right the net can be opened and closed as desired. After closing the net, unhook the wire from the loop in the end of the net and take the specimens out in the usual way.

The advantages of such a net are as follows: (1) It holds the net open, thus making it easier to place it over Lepidoptera or other winged insects, which immediately fly toward the closed end of the net; (2) it catches more insects; (3) it allows free passage of air in sweeping instead of creating a breeze; (4) the net is in control at all times, that is, it can be opened or closed at will; (5) it avoids damaging insects by keeping the net off the ground; (6) specimens are in better condition; and (7) it prolongs the life of the net.

The author has had very good success with this net, not only in sweeping but also in collecting individual species that were otherwise difficult to obtain.

C. C. Wilson, *Junior Entomologist,*
U. S. D. A., Bureau of Entomology

Some Spray Tests with Oil Emulsions.[1] It has been observed that in comparative spray tests we often fail to take proper cognizance of the fact that an emulsion undergoes certain quantitative changes during the process of manufacture. These changes may be discussed under the general topic of viscosity.

Perhaps the greatest single factor affecting viscosity is the volume ratio of the oil and water. While it is possible to produce an emulsion by use of only potash fish oil soap and oil alone, or by the addition of an excessive amount of water to the oil and soap, experiment has shown that there is an optimum proportion.

[1]This work was done at the Illinois Experiment Station.

A deficiency in the proportion of soap results in lower viscosity due to the prevalence of larger oil globules. These large globules have a tendency to break the film surrounding them and then coalesce.

The size of the oil globules are further dependent upon the temperature of the mixture when it is agitated. A cold mixture will yield an emulsion physically inferior to a hot mixture. However, field and laboratory tests have shown that there is nothing to be gained by continued application of heat. Indeed, the amount of heat applied is a factor to be taken into consideration when tests of various emulsions are being made, for it has an important bearing upon the concentration of the oil. It is apparent that heating only facilitates emulsification in that it lowers the viscosity of the mixture and reduces the interfacial tension between the oil and water phases.

Another factor affecting viscosity is the degree of mechanical agitation. Within certain practical limits the more often the mixture is forced thru the pumps and the greater the pressure, the more viscous is the end product. This is due to the fact that the oil is reduced to more minute globules which in turn greatly increase the extent of the oil-water surface.

It is, therefore, quite evident that the ratio of oil and water and soap, the degree of mechanical mixture, and the amount of heat applied to the mixture before emulsification are factors which taken collectively have an important influence on the increase in volume. In as much as the oil is the killing element of an emulsion its concentration should be known if the tests are to be used in a comparative way.

The data tabulated below tend to prove that the above factors, especially the ratio of oil, water and soap, have an important bearing on the kill of scale. Two different formulae were used. The spray solutions were tested on San Jose scale, five hundred being counted for each test or a total of 2000 for the entire experiment.

I Formula: Oil 1 Gallon, Water ½ Gallon, Soap 2 Pounds

Emulsion	Water	Per cent of Oil in Spray Solution	Per cent Dead Scale
1½ gal.	100 gal.	.007	73.
3 "	100 "	.015	97.6
4½ "	100 "	.022	98.3
6 "	100 "	.030	100.

II Formula: Oil 1 Gallon, Water ¼ Gallon, Soap 1 Pound

Emulsion	Water	Percent of Oil in Spray Solution	Percent Dead Scale
1½ gal.	100 gal.	.010	89.
3 "	100 "	.020	98.5
4½ "	100 "	.030	99.4
6 "	100 "	.040	100.

L. L. Huber, *Department of Entomology, Ohio Agricultural Experiment Station*

Notes on the Corn Earworm in Eastern Massachusetts. The corn earworm (*Heliothis obsoleta* Fab.) is so intimately associated with the European corn borer (*Pyrausta nubilalis* Hubn.) as an enemy of the corn plant that the writer has followed the history of this insect in Eastern Massachusetts during several years. The answers to the following two questions relating to the life history and economy of this species have been especially sought: first, Has the corn earworm more than a single generation

during a season in Massachusetts?; second, Is the corn earworm able to pass the winter successfully in this latitude?

In this section the corn earworm was particularly abundant during 1921, becoming a pest of real importance in late corn that year. It has been less plentiful during the three years immediately following although in some localities a slight amount of damage has been found. On August 9, 1924, full grown larvae were found in the earliest maturing ears of a field of early sweet corn at Cliftondale, Mass. On this date larvae were already moving to the soil to pupate, and by August 16 pupation was nearly complete. Since the infestation was only found in the earliest ears of this corn it is evident that the flight of moths of which these larvae were the progeny occurred about the middle of July, and that the moths deposited eggs on the most advanced ears the silks of which were then appearing.

In cages, adults from these pupae emerged from September 15 to September 26, but young larvae were found in the field as early as September 12, indicating that individuals had pupated somewhat earlier in the field than had the caged insects which were later-developing individuals collected after many larvae had already entered the soil. Young larvae were found thereafter in the field in some abundance and, as in the previous brood, they varied little in size, the brood being distinct and not to be confused with the preceding one. This second brood of larvae reached maturity between October 8 and 16, and by the latter date pupation was well under way. Here, then, is proof that during 1924 two generations of this insect occurred in Eastern Massachusetts.

In the fall of 1921 fifty pupae of the corn earworm were placed in the soil in different ways to observe if they would be able to survive the winter. Examination in the spring of 1922 showed that all these pupae had perished, and by following a plow in the field where these insects had been most abundant the preceding fall no trace of living pupae were found. No moths were seen nor did any infestation develop during the early summer of 1922 that would indicate the successful overwintering of this insect. Of eight pupae kept indoors in dry sand through the winter all issued between March 14 and 23. In the fall of 1924 several pupae resulting from the second brood of larvae that year, previously mentioned, were kept in screen cages in the insectary to observe the possible effect of the first freeze. On November 17 to 19 average temperatures of from 10 to 15 degrees F. were experienced and on November 21 examination of these pupae, 12 in number, showed that all had perished during this cold period. It seems, therefore, that this insect is unable to withstand freezing temperatures and that the freezing of the soil is fatal to pupae during the winter in this area. Freezing also seems to be fatal to the larvae, since in the fall of 1921 large numbers were found dead in the ears of corn after the first freezes of the season.

GEO. W. BARBER, *Cereal and Forage Insect Investigations,*
Bureau of Entomology, U. S. Department of Agriculture.

Notes on *Thrips tabaci* Lindeman. During an investigation of the life history of the onion thrips, *Thrips tabaci* Lindeman, in the seasons 1923 and 1924, certain notes have been made which would doubtless be of general interest. The length of life of the adult does not seem to have been satisfactorily determined as yet, but there are a few scattered records to add to those already published. Lindeman, in his account of the history of the insect, says, "The imago appears to live but one day." It would certainly be a boon to onion growers if adult thrips were killed off so early in life.

Quaintance has made the only observation of this sort, on the insect in this country, that I have found. It is as follows:

"Length of life of an adult was not satisfactorily determined. Specimens were kept, however, for nearly three days, when they met with an accident."

In 1923 especial records were made in three cases, the adults living after emergence from the last nymphal stage twenty-one, seventeen and fifteen days, respectively. The last two records, however, were not completed since the experiment was necessarily discontinued early in September. It was decided to carry on similar experiments in 1924, so as to determine if these records might not be accounted for by the lateness of season and the possibility of the adults preparing to overwinter.

In 1924 a single female was successfully confined for fifty-eight days after its final moult. Its life may be summarized as follows:

Egg laid, June 19th,
Young hatched, June 23d;
Adult emerged, July 7th,
and died, September 3d.

It might be added that several "children" and at least one "grandchild" of the "venerable lady" were successfully reared before the end of the season.

Of like interest are two records of adults taken, along with others, in the field on July 14th and kept in confinement until September 2d, a total of 50 days. One of the thrips was then dead and the other missing.

As a matter of fact, of the bulk of material bred very many of the adults lived for a longer period than published records indicate to be the case. The above records are, however, the outstanding instances of longevity noted in the course of the investigation.

H. H. SHEPARD,
Massachusetts Agricultural College, Amherst, Mass.

Why Not Trap-Crops That Entrap? Much has been written on the subject of trap crops as a means of controlling insect pests, the usual method of utilizing the trap crop being to shake or otherwise collect the injurious insects from it at the time they are most abundant, or to destroy the insects and trap crop simultaneously. An ideal trap crop would be one which possesses qualities by merit of which it will attract and destroy insect pests unaided. While I do not recall having heard of the utilization of such a plant, until recently, it was my fortune to find two plants of this character in the course of some investigations of the parasites of the Mexican bean beetle, *Epilachna corrupta*, carried on in Mexico and Guatemala for the Department of Agriculture during the summer of 1923. Both plants are capable of utilization on a large scale for insect control, and I consider them of great potential value.

One is a leguminous plant belonging to the genus of the common "beggar weed," and determined by Paul C. Standley, of the National Museum, as *Meibomia amans* (Wats.). It grows to a height of 3 to 5 feet and is abundantly branched and spreading. The stems and leaves are copiously covered with fine hairs that thickly cover the surface, each hair having an inverted or hooked point. The bristles and pubescence on the legs and bodies of insects that come into contact with the plant become so engaged with the hooked hairs of the plant that the insects seem unable to escape, and usually die captive, and dry up still clinging to the plant. The plants observed had a varying assortment of insects, both dead and alive, clinging to stems and foliage.

Flies, Hymenoptera, small beetles and occasional leafhoppers were the insects most in evidence on the plants, tho larger insects, even grasshoppers, were sometimes caught. So adhesive are the stems as result of the hooked hairs that they are very difficult to disengage from the clothes or the hairs on the back of the hand, and the dried specimens clung persistently to the blotters between which they were pressed.

The plant was found growing wild in fields and along roadways at Cuernavaca, and in the foothills north-east of Oaxaca, Mexico. Strangely enough, another plant of the same genus—an undetermined species of Meibomia quite unlike this plant—was found to be the wild food plant of the Mexican bean beetle at Cuernavaca, and was attacked even in preference to cultivated beans. Because of the close relationship of the two plants it seems not improbable that *Meibomia amans* might have some attraction for the bean beetle, and might be utilized to great advantage in its control by planting it around fields of beans, or in alternate rows with the Meibomia which is known to be attractive to the pest. A plant growing to a height of five feet and so profusely spreading, and one whose adhesive qualities upon contact are quite comparable to those of sticky flypaper, if planted in a dense row about a patch or field of beans should act as a very substantial, yet cheap, barrier against the ingress of beetles flying close to the ground.

The other plant of this character, of equal or perhaps greater value for insect control is a South American grass, *Melinis minutiflora*. It possesses very marked adhesive qualities, manifest over the entire pubescent surface of the plant, but to a less marked degree than the preceding plant, hence is capable of trapping only small insects. According to Señor Don Garcia Salas, Director General of Agriculture in Guatemala, who gave me the determination, this grass was brought from Brazil to Guatemala by Señor Pivaral about the year 1915, for experimental purposes as a forage plant. The Brazilian name for it is "Campin gordura" (fattening grass); the Guatemalan name, "Zacate emoliente," which translated means about the same. The great utility of the grass lies not alone in its high nutritive value, but in the fact that it traps and kills young seed ticks, newly hatched, as they attempt to climb up the stems from the soil to gain access to passing live stock. It is said that cattle pastured exclusively in this grass become entirely freed from ticks within a year from inability of the ticks to propagate. On the Guatemalan Government Farm at La Aurora, near Guatemala City, which is under direction of Señor Salvador Herrera, Minister of Agriculture in Guatemala, there are several fields of this grass being propagated for experimental purposes. One live stock man, Señor Salvador Mateo, who had in 1923 about five thousand square rods of this "tick-tight" grass on his hacienda in the coast lands of southern Guatemala, told me that he finds the grass very successful as a tick eradicator and is constantly enlarging his acreage with the hope of eventually using no other kind of grass. He finds it equal to most other grasses in nutritive value, not excepting Guinea and Para grass, and states that while stock is inclined to avoid the grass when first put into a field of it, it later develops a liking for the grass and seems to prefer it to the higher, coarser grasses indigenous to Guatemala. He even stated that the cattle seemed to learn and recognize the protection from ticks afforded them by the grass and to seek and remain in it in consequence. Other stockmen of the country, Señor Ricardo Vasquez of Finca El Pinon being one of them, have had similar experience with this very promising forage plant, so that the demand for seed of the grass greatly exceeds the available supply.

There is little doubt that this grass would find great favor among stockmen of the South, and among dairymen and those raising oxen for sugar plantations in climates like those of Florida and Porto Rico. It also has possibilities of utilization in other ways to control insects, such as for planting in the "callejons" between cane fields to control leafhoppers, or bordering sugar beet fields where curly-top is a menace and anything that will destroy leafhoppers is a thing most desirable. As a trap crop for aphids it is also ideal. E. GRAYWOOD SMYTH, *New York City*

The Asparagus Beetle (*Crioceris asparagi* Linn) **in Washington and other Pacific Coast States.** Like many another crop pest which has slowly but surely followed the introduction of a given crop into new territory, the Asparagus Beetle has finally made its appearance in the Yakima Valley of Washington where it was unknown heretofore.

Chittenden[1] in 1917 discussed the distribution of this pest as follows:

"The common asparagus beetle was introduced at Astoria, near New York City, about 1856. From there it soon spread to the asparagus farms in Queens County, N. Y., and by 1862 was reported to have occasioned the destruction of more than one-third of the crops in certain localities. . . . To date the common asparagus beetle has been reported in 19 States and the District of Columbia and in several localities in Canada. Its known distribution now extends from Toronto, Canada, through New York and New England, except Maine, to southern North Carolina and westward to the border line between Illinois and Iowa, and in addition it has been reported from one locality, Boulder, in Colorado, and three in California. Undoubtedly many localities in addition to these will be added in time, for it is rather certain that the insect occurs elsewhere in Canada and in some of our States, such as Maine, Iowa, Wisconsin and Illinois.

This species appeared at Bouldin Island, Cal., in 1904, but disappeared subsequently, probably owing to the fact that the island had been flooded, causing the extermination of the pest."

Essig[2] in 1913 stated, "In the year 1904, the insect was reported as occurring at Bouldin Island, Cal. In 1906 it was said to occur in great numbers at Oakley. It is now likely to be quite widely distributed throughout the central part of the State."

Lovett[3] in 1921 makes the statement "This beetle has recently appeared in Oregon."

Under date of Oct. 6, 1924, Prof. Don C. Mote, Entomologist of the Oregon Agricultural Experiment Station, in a letter to the writer, stated, "It is quite common and destructive in Oregon, and is apparently found wherever asparagus is raised. Our records show it to be very destructive in the Willamette Valley."

Mr. Anthony Spuler, Assistant Entomologist of the Washington State College, in a letter to the writer under date of October 31, 1924, stated: "We have no records of the occurrence of the asparagus beetle in the State of Washington."

In July, 1924, specimens of all stages of this insect were brought to the attention of the writer at the Bureau of Entomology laboratory. These specimens were identified by the writer as the several stages of the asparagus beetle, and a record was made of this as the first known occurrence of the insect in the State of Washington.

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[1]Farmers' Bul. 837 (Aug. 1917), Bureau of Entomology, U. S. Department of Agriculture.

[2]Essig, Mon. Bul. Cal. State Com. of Hort. Vol. II, No. 1 & 2 (1913) P. 226.

[3]Lovett. Ore. Agri. Ext. Bul. 325 (Feb. 1921), P. 22.

One small planting of asparagus from which some of the specimens had come, was examined and all stages of the insect found present. The plants were so badly infested that they were almost defoliated.

With a knap-sack duster these plants were dusted with a mixture of arsenate of lead and hydrated lime (4 to 1) on the 23rd of July. This application killed all of the larvae and all of the beetles that did not fly away upon my approach. But since there were also pupae and eggs present the control was not complete. On August 10th a few newly hatched larvae and one pair of adult beetles were found on the plants. They were again given a dust treatment, and after a couple of days no stages of the insects could be found. However, inasmuch as many of the beetles flew away when first approached, it is quite likely that some of them reached other plants in adjoining yards and that they will appear again in 1925 in greater numbers than this season.

Inasmuch as asparagus is an important commercial crop in the Yakima valley, especially in the lower districts about Kennewick, it is to be regretted that this pest is becoming established here and without any effort to suppress it upon its first appearance.

M. A. YOTHERS, *Bureau of Entomology,*
U. S. Department of Agriculture, Yakima, Wash.

How Soon after Spraying with Oil may Scale Control Results be Safely Scored? For the benefit of any who may contemplate control experiments with the San Jose scale this coming winter, the writers' experiences during the winter of 1923–1924 are here recorded. The action of lime-sulphur has long been known to be a slow process, and the following refers only to results with lubricating-oil emulsion.

Experimental spray applications, chiefly with the oils, were made by the second writer at Vincennes, Ind., during the middle of December, 1923. About six weeks later a start was made with the scoring of results, but at that time approximately 17 per cent of the scale *seemed* to be still alive. A few of these had begun to lose their clear lemon-yellow color, but were plump and juicy, and could not be safely scored as dead. Later on, during the tenth week following the spray application, a higher percentage of kill was apparent, but even at this time more than 5 per cent *appeared* to be alive. Counts made during the 12th week averaged 2.3 per cent alive, while final counts made the 16th to 18th week showed 0.4 per cent alive. Only one exception to this trend, and this only a slight one, occurred in seventy counts of 1000 or more scales each, in spite of the fact that when the later counts were made, the dead scales were sloughing off badly, resulting in an apparent percentage of live scales much greater than the actual percentage of survivors.

In untreated trees during the early winter the percentage of live scales steadily dropped, but the normal winter mortality seemed to be fully evident by the 11th week after the start of the experiments, as only slight changes occurred after that time.

In Illinois the first writer encountered a similar experience in experiments carried on in a latitude 80 miles farther south than those in Indiana. The usual practice had been to start counts a month after application, a period which, after several years' trial, had been found neither too long nor too short. This year, however, owing to continued cold, he waited for 5½ weeks, and was then nonplussed to find scales sprayed with the standard 2 per cent oil emulsion showing 22 per cent and 36 per

cent alive. It was apparent that some of the scales were off color in varying degrees, but no one would want to use his imagination to the extent of declaring which would finally die. Eight weeks after the application of the sprays, recounts were made, and the plots which had given the above percentages now showed only 1.3 per cent and 1.8 per cent alive, respectively.

While one month is ordinarily a sufficient period to allow the effects of oil spraying to become evident, this experience convinces the writers that a longer time may be necessary under some circumstances. The governing factor would seem to be the weather subsequent to the application. In these instances, except for a short time following the spray applications, the winter was consistently cold, with very few periods of warm, dry weather. The Weather Bureau report from Evansville, Ind., sixty miles south of the Vincennes experiments, showed an average daily temperature deficiency from January 1 to March 31, 1924, of 3.8°, while the official report for Anna, Ill., where the Illinois experiments were carried on, showed for the same period an average daily deficiency of 2.8°. It seems plausible that under these conditions the killing action of the oil may have been unusually slow, and that after the scales were actually dead, the continued cold weather retarded their drying out, which must take place before it can be finally determined whether the treated scales are alive or dead. It was much as if the scale material had been in cold storage during this period. At points further south, or in this latitude during milder winters, final counts may doubtless be made within the usual month to six weeks. Neither writer had difficulty in scoring treatments made during the spring of 1924 within a month after the time they were applied, but in the spring frequent periods of increasingly warm weather occur. With summer scale control experiments, ten days is often an ample interval between the spraying and the scoring of results.

The object of this note is to make the suggestion that the temperature following the spray applications be considered in determining the period which must elapse before the results of scale-control experiments with the oils may be safely recorded, and that in the more northern fruit regions, a too early scoring of the results of fall applications of oil may give misleading counts.

S. C. CHANDLER,[1] *Illinois State Natural History Survey,*
B. A. PORTER, *U. S. Bureau Entomology*

[1]The arrangement of author's names is alphabetical.

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

JUNE, 1925

The editors will thankfully receive news matter and other items likely to be of interest to our readers. Papers will be published as far as possible in the order of reception, except that papers of reasonable length may be accepted in the discretion of the editor for early publication, at $2.50 per page for all matter in excess of six printed pages; in the case of other matter, the maximum of 2,500 words is still operative. Photo-engravings may be obtained by authors at cost.

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It is difficult to visualize entomologists in charge of a fleet of airplanes, simply because it is out of the ordinary. Extension bulletin 301 of the Georgia State College of Agriculture outlines a plan for controlling boll weevil by airplane. This is the logical outcome of the work on cotton insects during the last few years and one of the more striking phases of large scale control work. It may be but the beginning of new methods for artificial control of insects. Note that the plan contemplates a trained executive, an essential to success, and adequate equipment. The latter is also essential. Soon we may see entomologists literally "up in the air" and for personal reasons, the Editor suggests that they find out, as opportunities occur, something about the various insects commonly found in the air, even at considerable heights.

The members of the Association have been advised recently of the appointment of a committee consisting of A. F. Burgess, Chairman, H. A. Gossard and C. W. Collins, to take action in regard to an endowment fund. It is understood that additions may be made to this committee at the next annual meeting. At the outset, attention is called to the constitutional provision for life membership, a very attractive method of adding to the endowment fund, and at the same time affording a reasonable return to members. There should be some entomologists in the organization sufficiently prosperous to afford a life membership, though not many to date have been able to provide diamond ear rings for the wife. There is nothing in the constitution or in the policy of the committee to prevent direct contributions to the endowment fund and

the chairman of this special committee suggests that members of the association can accomplish much by securing support for the endowment fund from individuals or organizations which have profited materially from the work of economic entomologists. Such contributions would not only be a recognition of the practical value of applied entomology but they would also, in helping the work of the Association, aid materially in the future development of economic entomology. It is another way of underwriting science.

Obituaries

ALBERT KOEBELE[1]

The story of Albert Koebele's life is, in a sense, dramatic. It is the story of a quiet, modest young man of German birth, comparatively uneducated, but with a keen eye, a skilled hand and a love of nature, especially attracted to entomology, who was thrown into big things at just the right time, and whose name will always be associated with a great accomplishment.

In this brief account I shall make no effort to emphasize the picturesque or dramatic qualities of his career, but they will be evident enough from a mere recital of events.

Unfortunately, I know nothing of Koebele's early life in Germany beyond the fact that he was born in 1852. He never talked to me about it. The facts connected with it will probably be significant, and they may come later, as I am in correspondence with his widow, now at Waldkirch, Germany. He must have come to America at an early date, since he was naturalized as an American citizen in New York City in 1880. He was a member of the Brooklyn Entomological Society at that time, and it was at a meeting of that Society that Riley first met him. The chief of the federal entomological service was struck by the beautiful mounting of certain specimens exhibited by Koebele at this meeting, and immediately proposed to him that he should come to Washington and work for the Department of Agriculture.

The appointment was arranged in the winter of 1881–2.

In Washington, Koebele found himself in congenial company. There were Schwarz, Pergande and Marx and, a little later, Lugger and John B. Smith, all of whom were of German origin and all of whom were ardent collectors.

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[1]The portrait of Koeble with this is from a rare snap shot which Mr. W. M. Giffard showed me in Honolulu in 1924 and which he generously had enlarged for me. L.O.H.

Yours truly

Alb. Koebele

Koebele was both a museum man and a field man, and his abilities as a field collector were recognized at once. At the time of his appointment we were still engaged in the investigation of the cotton caterpillar of the south, and the vexed question of the hibernation of this species in United States territory had not been settled. Koebele's first field commission took him to Georgia and Florida to work upon this question in the early spring of 1882.

In November of that same year, he started with the late John C. Branner on a trip to Brazil, largely to investigate cotton pests, with the Brazilian origin of the cotton caterpillar distinctly in mind. His time was spent largely in the regions about Bahia and Pernambuco, and the expedition returned on April 18, 1883, having sailed from Rio de Janeiro. Koebele's collections on this trip were marvelous, and very large series of Anomis and its relatives were collected, as well as extensive series of parasites.

In 1885, dissatisfied with life in the east, he begged to be transferred to the Pacific coast, and, as there were many important questions crying out for investigation in that part of the country, he was sent out there and settled at Alameda. He made this place his headquarters for the next three years, and carried on investigations of different crop pests and performed a number of experiments with insecticides, all the time sending to Washington boxes full of choice material, partly the result of careful rearing, and all accompanied with excellent notes, the specimens themselves being mounted in a way that has seldom been approached.

During the latter part of this period the white, or cottony cushion scale (*Icerya purchasi*) had begun to spread in southern California and threatened to exterminate the Citrus-growing industry. By correspondence, the Washington office had followed the Australasian distribution of this insect, and had learned, through the late Frazer S. Crawford, of the occurrence of an important dipterous parasite of the scale insect in South Australia. An arrangement was made between Mr. Frank McCoppin of California (the United States Commissioner to the Melbourne Exhibition) and Professor Riley that an expert assistant in the entomological service of the government should be sent out to Australia for the purpose of investigating this question of parasitism, his salary to be paid by the Department and his expenses to be paid from the Exhibition fund under the control of Mr. McCoppin. On account of his ability as a collector and from the further fact that he was stationed in California, Koebele was chosen, and the miraculous results that followed are known to the entire entomological and horticultural world. It is

interesting to note that when Koebele arrived at Adelaide, South Australia, Mr. Crawford at once showed him scales infested by the parasitic fly (Lestophonus), and that it appeared that the Icerya, although it undoubtedly occurred there, was rare, presumably from the work of the parasite. At the same time Koebele found the ladybird, *Novius* (*Vedalia*) *cardinalis*, which was to become so famous. It is also interesting to note that Koebele sent to California approximately ten thousand of the Lestophonus, which, however, subsequently proved to be a comparatively unimportant enemy of the scale in California. But the Vedalias which he sent survived the journey, multiplied rapidly, and in a few months cleared up the scale situation in southern California. This story has been so often written that it is not necessary to elaborate.

Koebele returned to the United States in 1889, and in 1891 was again sent to Australasian regions under a fund of five thousand dollars raised by the Fruit Growers'Association of California, his salary still being paid by the Federal Department of Agriculture. On this trip he sent over a number of beneficial insects from which much was expected, notably the Coccinellids, *Orcus chalybeus*, *Orcus australasiae* and *Rhizobius ventralis*, but none of these made any marked impression upon any of the injurious insects of California, although for a time one of them promised good results against the black scale in the Santa Barbara region. A result of this expedition, however, which did prove of importance was the sending of *Cryptolaemus montrouzieri* which has proved a very effective enemy of mealybugs in different parts of the world.

Prior to this second expedition to Australia, at the convention of the California Fruit Growers'Association held at Santa Cruz, California, on November 18, 1890, President Elwood Cooper called Koebele to the platform and made a complimentary address and presented Koebele with a gold watch for himself and a pair of diamond earrings for Mrs. Koebele, on behalf of the fruit growers of California. The fund collected had exceeded the amount necessary for the purchase of these presents, and the balance was given to Koebele in cash.

I have an indefinite recollection that an effort was made to collect a sufficiently large sum to purchase a house in Alameda for Koebele, but I cannot substantiate this recollection from any available contemporary printed evidence.

The mention of Mrs. Koebele reminds me that, after he went to California, Koebele sent to Germany for a particular one of his early girl friends and that she came to California and married him. I imagine that this presentation of diamond earrings to the wife of an entomologist

as the result of his own work in entomology is probably unique. I happen to know of no other entomologist who has been able to see that his wife wears diamond earrings!

On his return from his second trip, he resumed work for the Washington Department and made several reports on his California investigations which were published in the Old Series Bulletins of the Division of Entomology and in Insect Life. On September 30, 1893, he resigned from the Department and was given an appointment by the Board of Agriculture and Forestry of the then provisional government of Hawaii.

His first few months were spent in an exploration of the Hawaiian Islands and a study of their insect fauna, and apparently in 1895 and a part of 1896 he was traveling in Australia, Ceylon, China and Japan, collecting parasitic and predatory insects for introduction into Hawaii.

In 1897 he remained in Hawaii, at least for part of the year, but his report published in 1898 indicates that he spent some time in California, Arizona, Texas, Mexico and Pennsylvania.

In 1899 and 1900 he was again traveling in Australia, the Fiji Islands and other South Pacific countries, part of the time at least in company with George Compere of California, returning to Honolulu in April, 1901.

In 1901 and 1902 he was traveling in Mexico in search of the insect enemies of the Lantana weed, and on the conclusion of this investigation he visited the United States on the first of his trips to look into the matter of parasites of leaf-hoppers, since the sugar-cane leaf-hopper had become of much prominence in Hawaii. It was on this trip that he came to Washington to consult me, since he knew of my catalog of the host relations of the hymenopterous parasites. O. H. Swezey, of Columbus, had just published a note on a dryinid parasite of leaf-hoppers, and, after telling Koebele of the European observations of Alfred Giard and others on the parasitism of leaf-hoppers by Dryinidae, I sent him to Columbus where he found Swezey. From this visit Swezey's Hawaiian engagement resulted, which has lasted to the present time.

Koebele returned to Hawaii in May, 1904, and sailed for Australia and other South Pacific islands with Perkins. Perkins returned after a few months, leaving Koebele in Australia, from which country he returned in 1906, having in the meantime visited Ceylon, China and Japan, where he found valuable parasitic insects.

He was then sent to the United States on a quest for parasites of the horn fly, and spent some months in California, Arizona and Sonora, the horn fly having made its appearance in Hawaii in 1907.

In 1908 he went to Europe, and from that time until 1911 he stayed in

Europe, with an incidental journey to North Africa, sending over the natural enemies of the horn fly. These included not only hymenopterous parasites but predaceous insects which feed upon the fly larvae in the cow dung.

In 1912 his health failed, and his services for Hawaii were discontinued while he was still in Europe.

From 1912 until his death at the end of 1924 he remained in Germany. His eyes were operated upon in 1912 or 1913, but when his sight permitted he did occasional work for the Hawaiian government, and I think about this time he was pensioned.

The outbreak of the war prevented his return to this country. In March, 1917, he had to undergo another eye operation.

After the armistice he contracted malaria in addition to his other troubles, and apparently never fully regained his health.

In 1921, he appealed to Mr. E. K. Taylor, of Alameda, California, a neighbor of his when he lived in Alameda, a prominent man, ex-Mayor of the city and attorney for the principal bank, to get him permission to return to Hawaii through this country. His friends in Holonulu advanced money enough to cover his traveling expenses; but Mr. Taylor, although he tried in every way to bring it about, could not secure permission for him to reenter the United States, although he had been naturalized in 1880 in New York City.

In a letter to Mr. Taylor in 1920, Koebele wrote that for the first time in very many months he had tasted white bread and sugar.

Mr. Taylor's efforts to secure admission for Koebele to the United States were so strenuous as to arouse Koebele's great gratitude; and, in writing to Senator Shortridge about the matter under date of April, 1921, Mr. Taylor said, "He commended me so generously for what I had tried to accomplish and so far failed, that I feel ashamed to eat another orange." This way of expressing it was indicative of Mr. Taylor's belief that Koebele had saved the orange industry of California. The Hawaiian people, principally the Sugar Planters Association, interested themselves strongly in the effort to get Koebele back there, and Mr. W. M. Giffard especially exerted himself, but unfortunately to no avail.

It is possible that portions of Koebele's collections are still in his old house on Regent Street in Alameda. When Mr. Taylor wrote, that was the case; and Koebele expected to rearrange his collection on his arrival in California and to present it to the State.

My impression is that a considerable part of this material has already

found its way to the California Academy of Sciences. I think I was told so by Professor Van Duzee last summer.

According to a letter received recently from Mrs. Koebele, he died December 28, 1924, at Waldkirch.

I realize that the rather summary account of his life which I have given is by no means as full as it should be. I hope that Mr. O. H. Swezey in Honolulu and Mr. R. C. L. Perkins, who is now living in England, will also write accounts of his life, especially of those portions of it during which they were more or less intimately associated with him, and that they will evaluate his great service to Hawaii.

During all of his travels, especially the earlier ones, Koebele was in rather constant correspondence with me, and sent on quantities of parasitic material for identification. The bulk of this material and very many of his notes are now in possession of the National Museum. From the museum point of view, his material is of very great value, and from the biological point of view it is of even greater value. His invariably full and careful notes were models. He was one of the best collectors and one of the most skilled preparators who ever lived, and the results of his work have been of great value to this country and Hawaii. His articles were comparatively few and consisted of very brief reports in the Monthly and other Hawaiian Sugar Planters publications, in the Bulletins of the Old Series of the Division of Entomology of the U. S. Department of Agriculture, and his two reports on his expeditions to Australia under the Department of Agriculture.

I notice that some of the Germans are now referring to the international exchange of natural enemies of injurious insects as "the Koebele method." This, while natural enough (since although Koebele was an American citizen he was always to the Germans "Unser Landsmann"), seems hardly fair to the memory of Riley who directed his early work and made it possible.

It is in such ways as this (now that he is dead) that Koebele's standing as a man of science is likely to be exaggerated. What he did for California we know, and we know how he did it. What he did for Hawaii we know, and a just statement of its importance will doubtless be published by Mr. Swezey or Doctor Perkins or both. But it distinctly must be remembered that he was not a scientific authority, that he was not an educated and broadly trained entomologist, but that he was a marvelous collector, the keenest of observers, attentive to the minutest details, and a man of indefatigable industry when in his prime, who seized at once the wonderful opportunities that came to him and who thus became

a most productive pioneer in a movement and a method which has already been of great help to humanity in its fight against injurious insects and which promises much to the future.

L. O. HOWARD

FRANKLIN HERBERT MOSHER

FRANKLIN HERBERT MOSHER, one of the assistant Entomologists at the Gipsy Moth Laboratory at Melrose Highlands, Mass., died suddenly from an attack of pneumonia on April 18, 1925. He was born at Dartmouth, Mass., September 3, 1861, and was one of a large family. He lived on the home farm and after attending the local schools completed the regular course at the State Normal School at Bridgewater, Mass. After teaching for several years he entered the employ of the Gipsy Moth Committee of the Massachusetts Board of Agriculture in 1894 and was assigned to field work on the gipsy moth project.

He was a great lover of nature, was gifted with unusual powers of observation and his services were soon utilized in making careful studies of the behavior of the gipsy moth in the field. Particular attention was paid to the usefulness of birds in destroying this insect and he also conducted many other experimental projects. When the State work was discontinued in 1900 he returned to his home farm where he remained with the exception of one season spent in insect control work on a large estate in the Hudson Valley, New York.

His interest in Entomology and other phases of natural history increased during this time and he was one of the first men to be employed when the state resumed gipsy moth control work in 1905. He cared for the first shipments of European parasites of this insect that were shipped to the United States and assisted in the breeding and colonization of these species. In 1911 he was appointed on the rolls of the Bureau of Entomology and has been engaged in experimental work at the Gipsy Moth Laboratory since that time.

Mr. Mosher was of a modest and retiring disposition, a man who avoided publicity and deprecated superficial work or show of any kind. His publications were small in number but the records were thorough and accurate and his advice and assistance was sought and utilized on many of the problems dealt with at the Laboratory. He was very careful and thorough at his work, always dependable, a staunch and loyal friend, devoted to his home and family and highly respected in the community in which he lived.

A. F.

MAJOR F. W. CRAGG

In the tragically sudden death of Major F. W. Cragg, M.D., D.Sc., which took place in India on April 23, 1924, another name is added to the roll of martyrs to medico-entomological research. His name is added to that ever lengthening roll of honor, on which scroll are found the names of Dr. Howard T. Ricketts, who demonstrated the tick transmission of Rocky Mountain spotted fever, and later succumbed to typhus fever in Mexico while demonstrating the transmission of "Tabardillo" by the body louse; of Dr. Thomas B. McClintic and of Dr. Arthur McCray, both of whom succumbed to infection received while investigating Rocky Mountain spotted fever, as well as others.

An extended account of the life work of Major Cragg appears in the Indian Journal of Medical Research of July, 1924, pp. 5–9, which has recently come to hand. The death of Major Cragg took place following his detail in December, 1923, at his own request, to investigate the insect transmitted fevers with the view to definitely determining the coexistence of typhus fever with relapsing fever in India. He had, not more than 18 months before, recovered from a severe attack of relapsing fever contracted while on a field investigation, yet he returned to Kashmir to do similar work on typhus fever. Major Cragg was almost 42 years of age at his death. His earlier service in India was at Madras at the King Institute of Preventive Medicine, where in 1913, in collaboration with Major W. S. Patton, he produced a notable contribution in the well-known Textbook of Medical Entomology (pp. XXXIV + 768, pls. 89). At the time of his demise Major Cragg was engaged upon a new text-book, an Introduction to Medical Entomology, which was nearly ready for publication.

Our sympathy goes out to the widow and two children that survive him.

W. A. H.

WALTER BRADFORD BARROWS

In the January (1925) number of The Auk (pp. 1–14), the official organ of the American Ornithological Union, Dr. A. K. Fisher, of the U. S. D. A. Bureau of Biological Survey, gives a very pleasing account of the life and work of Walter Bradford Barrows, the ornithologist and an old friend and former associate, who was Professor of Zoology at the Michigan Agricultural College from the fall of 1894 until his death on February 26, 1923. The writings of Professor Barrows (a list of 59 separate publications accompanies the account) are nearly all upon ornithological sub-

jects and include large bulletins of the Biological Survey on the English sparrow (1889) and the crow (1895), and an 822-page work on Michigan bird life (1912). During the years 1897 and 1898 Professor Barrows served as Entomologist at the Michigan Experiment Station, and was the author of papers on "The Present Status of the San José Scale in Michigan" and "Notes on the Malodorous Carabid, *Nomius pygmaeus* Dej.," both of which appeared in Bulletin No. 9 of the U. S. D. A. Bureau of Entomology.

W. A. H.

Current Notes

Professor Alexander Petrunkevitch, professor of zoology in Yale University, has received a year's leave of absence to study zoology in Porto Rico.

Dr. W. D. Hunter of the Bureau of Entomology was recently elected a trustee of the Tropical Plant Research Foundation, for a term of five years.

The brown-tail moth scouting in Nova Scotia was terminated on March 31. A total of 154 nests were found this season, as compared with 70 the previous year.

Mr. E. R. Buckell was promoted to the position of Entomologist, in charge of the Vernon Laboratory, B. C., of the Canadian Entomological Branch, dating from March 1, 1925.

Mr. Charles Esselbaugh, a graduate student, Department of Entomology and Zoology, Ohio State University, has been employed by the Ohio Station to assist at the Corn Borer Laboratory at Oak Harbor.

Dr. L. O. Howard is one of the representatives in the United States of the International Commission of Agriculture which will hold its twelfth congress at Warsaw, Poland, June 21–24, 1925.

Mr. F. G. Gambrel, formerly a research fellow with the Crop Protection Institute, has recently been appointed research assistant in Entomology at the New York (Geneva) Agricultural Experiment Station.

The annual meeting of the Entomological Society of British Columbia was held at Vancouver, B. C., on February 14. Messrs. Buckle, Downes and Glendenning of the Entomological Branch attended and presented papers.

Professor W. C. O'Kane is the author of a book "Trails and Summits" which has just been published by Houghton Mifflin & Co. This book describes the trails and views on 19 different summits of the White Mountains.

Mr. Harold E. Gray of Lethbridge, Alberta, completed his work for the Bachelor's Degree in Entomology at Montana State College in March and has accepted a position under the Canadian Government as Junior Entomologist and will be stationed at Lethbridge.

Mr. Charles Schaeffer of the Brooklyn Museum recently visited the Division of Insects, U. S. National Museum, for a few days, examining the collection of Coleoptera and consulting with the specialists, and was also present at the conference discussing the handling of the Casey collection.

Mr. R. L. Miller, a graduate from the entomology course at Ohio State University, commenced work with the Departments of Entomology and Plant Pathology of the Ohio Station, April 1, under the Sherwin-Williams fellowship, and will investigate the merits of spraying materials made by this Company.

In a letter written since his arrival at Suva, Fiji Islands, Dr. J. D. Tothill of the Canadian Entomological Branch reports that he is comfortably established and has taken up his new work. Efforts are being made to discover effective parasites to control the caterpillars injurious to the cocoanut groves.

Mr. E. T. Cresson, Jr., of the Academy of Natural Sciences of Philadelphia, spent a number of days in the Division of Insects, U. S. National Museum, examining types of flies belonging to the family Ephydridae. Mr. Cresson also represented the National Academy of Sciences at the conference discussing the handling of the Casey collection.

Mr. H. L. Viereck of the Canadian Entomological Branch, sailed from Southampton, England, on April 23 on the C. P. O. S. liner Minnedosa, landing at Montreal on May 1. Mr. Viereck reports that his brief stay in London proved very interesting. He spent two weeks studying Hymenoptera at the British Museum of Natural History, South Kensington.

Mr. C. C. Hill of the Bureau of Entomology has been placed in charge of the Carlisle, Pa. laboratory of the Bureau on account of the death of Mr. P. R. Myers. Mr. Hill has acted as first assistant for several years, was very close to Mr. Myers both in his personal relations and in his professional work and will be able to continue the research work most advantageously.

Mr. William Middleton of the Bureau of Entomology recently visited the Taylor estates near Trevilians, Va., taking with him a number of cages of elm leaf beetles parasitized by the dipteron *Erynnia nitida* R. D., received from Dr. W. R. Thompson, of Hyeres, France. With this material an attempt will be made to establish the parasite in this country.

According to *Science*, Professor T. D. A. Cockerell of the University of Colorado and Mrs. Cockerell will visit Argentina the coming summer to examine two localities where fossil insects have been discovered, near the eastern base of the Andes. Mrs. Cockerell is writing a book on the zoology of Colorado, to be published next year by the University of Colorado.

Mr. C. H. Curran of the Division of Systematic Entomology, Canadian Entomological Branch, left Ottawa on February 23 for Washington, D. C., where he spent several days in the U. S. National Museum studying types of Diptera. Before returning to Ottawa he expected to stop off at Philadelphia for a short period to continue his studies in the Academy of Natural Sciences.

Prof. Karl Sajo of Hungary was active April 23, 1925, according to Prof. A. C. Kinsey, consequently his reported death (see page 6 of this volume) was "greatly exaggerated." American entomologists are certainly gratified that the above-mentioned report proved to be unfounded, and all gladly join in wishing him many additional years of productive activity.

The Nantucket tip moth, *Rhyacionia frustrana* Comstock, was found to be quite abundant in certain plantations of loblolly and slash pine in eastern Lousiana. The former species was considerably stunted in its growth. In some cases young

growth about five years of age had attained only half of its normal height. The slash pine was only slightly affected in its growth.

Mr. L. H. Worthley of the Bureau of Entomology is conducting a clean-up campaign against the European corn borer in western Long Island and eastern Staten Island, where isolated colonies of the insect have been discovered. The methods followed consist principally in burning over the infested areas by the use of specially designed burners and fuel oil. Good progress has been made in this work, as the weather has been very favorable.

The State Board of Entomology of Tennessee received several handsome increases in appropriations for its different budgets from the Legislature just adjourned. A thousand dollars a year increase was made for temporary help, a thousand dollars a year increase for sweet potato certification, a thousand dollars a year increase for apiary inspection and $2,500.00 a year increase for budgets such as salaries, supplies and material.

Mr. Arthur Gibson, Dominion Entomologist of Canada has recently given addresses as follows: February 28, "The Fight Against the Insects," Victoria Museum, Ottawa. This address was accompanied by a motion picture entitled "Insects at Work and How They Are Controlled;" March 31, "The Work of the Entomological Branch," broadcast by radio from Station CKCO., Ottawa; April 24, "Insects and Their Habits," Devonshire Home and School Club, Ottawa.

The following transfers in the Bureau of Entomology have been announced: W. A. Baker, San Antonio to Dallas, Tex.; J. A. McLemore, Lyman to Picayune, Miss.; Troy Thompson, Ocean Springs to Waveland, Miss.; K. P. Ewing and A. C. Johnson, Federal Horticultural Board, to Port Lavaca, Tex.; T. P. Cassidy, after temporary assignment with the Federal Horticultural Board has returned to the Bureau and has been assigned to the vicinity of Tucson, Ariz.

The laboratory of the Canadian Entomological Branch at St. Thomas, Ont., which is in charge of Mr. A. B. Baird, will shortly be transferred to Chatham, Ont., owing to the heavy increase of the European corn borer infestation in the counties of Essex, Kent and Lambton. The new laboratory at Chatham will also be used as a headquarters for members of the Division of Field Crop and Garden Insects engaged in corn borer control work, and for western Ontario nursery stock inspection.

Dr. Alvah Peterson, Associate Professor of Entomology of Rutgers College and Associate Entomologist of the New Jersey Agricultural Experiment Station, resigned effective May 1, to accept a position as Entomologist in the Bureau of Entomology. Dr. Peterson will act as project leader in all investigational work on insects attacking peaches, and for the season of 1925, most of his work will be in connection with the Oriental peach moth, and his headquarters will be at Riverton, N. J. His permanent address is Bureau of Entomology, Washington, D. C.

Mr. Paul Revere Myers of the Bureau of Entomology died February 12 from septic pneumonia. Mr. Myers was a student of parasitic Hymenoptera and for several years was in the U. S. National Museum. At the time of his death he was in charge of the Carlisle, Pa. field station, Division of Cereal and Forage Crop Insect Investigations of the Bureau. Mr. Myers was born February 15, 1888 at Harrisburg, Pa. A widow and two children survive him. A more complete account of his life and work may be found in the Proceedings of the Entomological Society of Washington, Vol. 27, page 66, April, 1925.

On March 21, Dr. R. T. Cotton of the Bureau of Entomology went to Kansas City to represent the Bureau at a field demonstration on a large scale staged by the United States Industrial Chemical Company of Baltimore. This company is the only one at present offering the public the new fumigant, ethyl acetate-carbon tetrachloride mixture. Dr. Cotton has reported that the grain interests appear to be very well satisfied with the results of the demonstrations already conducted so far as they concern toxicity to insects, but criticize the odor left on the grain.

An informal meeting of the Entomologists of Kansas was held at the Kansas State Agricultural College, April 9, on invitation of the Popenoe Entomological Club. Eighteen persons were present and the program was devoted to a general discussion of problems of local interest. The question of a check list of Kansas insects was considered, and a committee consisting of Warren Knaus, McPherson, R. H. Beamer, Lawrence, and H. R. Bryson, Manhattan, was appointed to inaugurate the work. An organization of the Entomologists of Kansas was formed, with Dr. P. B. Lawson, Lawrence, as President, and Prof. J. W. McColloch, Manhattan, Secretary.

The American Museum of Natural History has been granted the use of about forty acres of mixed forest and open land in the Palisades Interstate Park on which to establish a station for the study of insects. This tract is in the mountains near Tuxedo, New York. The station will furnish an excellent opportunity for technical research but its chief function will be educational. Living insects will be on exhibition during the summer season. These exhibits will be fully labeled, and, in addition, docent service will be provided for the more interested visitors. Dr. Frank E. Lutz is in charge.

Mr. H. G. Crawford has been appointed to the position of Chief of the Division of Field Crop and Garden Insects on February 1. This position was made vacant by the death of Mr. R. C. Treherne on June 7, 1924. Mr. Crawford was absent from Ottawa in southern Ontario from February 16 to 24 continuing work on the European corn borer control campaign in Lambton county. He gave lectures at numerous points within the infested area. He attended the annual conference of the North Central States Entomologists at Lafayette, Ind., March 5–6, and gave an address on "The Work of the Division of Field Crop and Garden Insects" before the graduate students at MacDonald College, May 1.

Five workers on aphids visited the Bureau of Entomology in January for a study of the collections and for consultation with the experts in this group. These were Miss Alice Macdougall, of Toronto, Canada, and Messrs. A. A. Granovsky of Wisconsin, C. R. Cutright of Wooster, Ohio, George F. Knowlton of Ohio State University, and A. H. Beyer of Florida. Mr. Cutright is making a special study of the biology and taxonomy of subterranean aphids and Mr. Granovsky is studying the Tribe Callipterini. Miss Macdougall brought with her an interesting collection of the aphids of western British Columbia, many of which apparently represent undescribed species. The discussion of these students emphasized the growing tendency to approach taxonomy from the biological viewpoint.

Dr. Craighead and R. A. St. George of the Bureau of Entomology spent about two weeks in February in Louisiana and northern Florida, making further observations on the extensive areas of pine which died last fall. It now appears that the trouble is practically over and that no trees have died since December, this fact further indicating that the extreme drought is the primary cause of the death of the trees. At

the same time several days were spent in field work with the officers of the Southern Experiment Station of the Forest Service. The interrelations between insects and fire and insects and turpentining were pointed out. It was found that certain borers play an important role in the weakening of fire-scorched and turpentined trees, making them very susceptible to wind-throw.

A conference of those in charge of nursery inspection of the Middle Atlantic and Northeastern States was held on Friday, May 15, at the Academy of Natural Sciences, Philadelphia, Pa. The following were present, representing their respective states: W. J. Schoene, Virginia; E. N. Cory, Maryland; W. E. Rumsey, West Virginia; C. H. Hadley, Pennsylvania; T. J. Headlee, New Jersey; Commissioner Wilson, Delaware; George G. Atwood, New York; W. E. Britton, Connecticut; A. E. Stene, Rhode Island; A. W. Gilbert, Massachusetts; W. C. O'Kane, New Hampshire. Maine and Vermont were the only states in the region which were not represented. At the same time, Governor Robinson, Senator Newton and Commissioner Wilson of Delaware discussed various phases of the Japanese beetle problem with Loren B. Smith and C. W. Stockwell of Riverton, N. J. Dr. Henry Skinner, in whose laboratory the conference was held, was also in attendance.

Recent appointments to the Bureau of Entomology have been announced as follows: Adonis A. Mathewson, a graduate of Ohio State University, for duty in connection with the European corn borer control work in Ohio and Michigan, with headquarters at Cleveland, O.; R. W. Haegle, temporary field assistant, wireworm investigations, Toppenish, Wash.; Robert C. Burdette, a graduate of the Maryland State University, junior entomologist, with Dr. C. H. Richardson, Insecticide Investigations, Sligo, Md.; Orville C. McBride, a graduate of Ohio State University, junior entomologist, citrus fruit insects, Orlando, Fla.; Dr. Henry Fox, associate entomologist, Japanese beetle project, Riverton, N. J.; H. S. Swingle, a graduate of Ohio State University, junior entomologist, peach insect investigations, Fort Valley, Ga.; Walter Carter, instructor in entomology, University of Minnesota, assistant entomologist, beet leafhopper investigations, Toppenish, Wash.; Dr. J. W. Folsom, assistant entomologist, boll weevil work, Tallulah, La.; Wm. S. Cook, for work with insecticidal dusts, Tallulah, La.; Mrs. Frances Marie Jones, as under scientific helper, Tempe, Ariz.; Charles S. Anderson, a skilled preparator has been appointed for temporary duty, European corn borer laboratory, Arlington, Mass.

By the will of the late Thomas L. Casey, his collection of insects and library on entomology have been bequeathed to the U. S. National Museum. This collection is one of the largest additions ever received by the National Museum and is estimated to contain about 16,000 species, of which probably 6,000 are represented by types. The addition of this collection of beetles will greatly increase the value of the Museum collection in this order and will make available to the Bureau specialists types of many species and Casey's idea of the limits of forms described by other authors. The collection will not become the property of the Museum until after the will has been probated, but in anticipation of its receipt, certain steps have been taken to formulate and discuss the best methods of handling this extensive gift, and on March 3, at the invitation of the Associate Curator of Insects, a conference of thirteen specialists was held. Most of the men attending this conference were coleopterists, and as a result of the meeting a set of resolutions was adopted expressing the views of those present.

Mr. S. M. Dohanian, Bureau of Entomology, sailed for France on February 11, 1925. He will make arrangements at Cherbourg and at Paris for the handling of

shipments of parasites of the gipsy moth and the brown-tail moth which may be sent to Melrose Highlands through these offices during the coming season. He will then proceed to Spain and Portugal and if suitable gipsy moth infestations can be located, will carry on several field laboratories during the summer in both countries. The purpose of this work is the continuation of the introduction of gipsy moth parasites and predators into the moth-infested areas in the United States. On February 21, 1925, Messrs. R. T. Webber and P. B. Dowden sailed for Bremen, Germany, to continue the foreign studies of the gipsy and brown-tail moths in central and southeastern Europe. They will establish several temporary field laboratories from which parasites will be sent to Melrose Highlands for study and liberation in this country. Mr. T. H. Jones sailed for Bremen on April 4, 1925, on a quick trip to central Europe to help collect and bring back the gipsy moth parasites which Messrs. Webber and Dowden will have at that time. He expected to arrive in Melrose Highlands near the end of May with this material, which will need constant attention en route. Mr. S. S. Crossman, who for the last three years, has been conducting the foreign parasite work for this section, will not go to Europe the present season. He has been made first assistant in the gipsy moth and brown-tail moth investigations. His duties at the Gipsy Moth Laboratory have been extended, and will necessitate his more constant presence at Melrose Highlands.

Pacific Slope Notes

The Dried Fruit Laboratory of the Bureau of Entomology was moved on March 9 from 422 Yale Avenue to 1584 Ferger Avenue, Fresno, California.

Mr. Ira J. Condit has returned to the University of California as associate in subtropical horticulture in the College of Agriculture, with headquarters at Berkeley.

Mr. A. O. Larson left Alhambra on April 15 for a two weeks' trip through the Sacramento and San Joaquin valleys, for a survey of the bean weevil situation, and to conduct a series of meetings on bean weevil control.

The following entomologists spent the week end of April 3–5 on a collecting trip in Palm canyon and vicinity, on the north-western corner of the Colorado desert: E. C. Vandyke, W. B. Herms, E. O. Essig and F. H. Wymore of Berkeley; H. L. Quayle, P. H. Timberlake, A. J. Basinger and J. C. Chamberlin of Riverside; A. O. Larson, C. K. Fisher, J. C. Elmore and Roy E. Campbell of Alhambra.

Dr. A. W. Morrill, consulting entomologist of Los Angeles, visited Florida during February to observe winter vegetable crop conditions there. He spent several days in Washington early in March in connection with entomological and miscellaneous agricultural matters, conferring with the members of the Federal Horticultural Board on the 10th. Dr. Morrill is interested in tomatoes and other vegetables through his connections with railroads and vegetable growing interests of the West Coast of Mexico. He has recently been appointed Consulting Entomologist to the Mexican Department of Agriculture and Development.

On February 25, Mr. J. C. Hamlin, in field charge of dried fruit insect investigations, returned to the Dried Fruit Laboratory of the Bureau of Entomology at Fresno, California, after a brief visit to Houston, Texas. Through the kindness of Doctor W. D. Hunter, Mr. Hamlin familiarized himself with the successful developments in

heat sterilization of cotton seeds, as a safeguard against the pink bollworm, which have been effected under Doctor Hunter's direction. It is thought that some of the machines in use in Texas may provide the basis for modifications which would make the heat treatment of certain dried fruits feasible.

Notes on Medical Entomology

Dr. A. Dampf, Entomologist of the Mexican Government, has been appointed Professor of Human Parasitology at the Universidad Nacional of Mexico.

According to *Science*, the gold medal of the Society of Pestology for 1925 has been awarded to Dr. Louis Sambon, for his work on the cockroach as a cancer carrier. Dr. Sambon delivered a lecture on the subject of his researches before the Pasteur Institute in Paris last December.

Dr. Samuel T. Darling has been nominated as a corresponding member of the Malaria Commission of the League of Nations Health Organization. Dr. Darling sailed from New York on March 21, to become director of an expedition to study malaria conditions in the Mediterranean countries of Switzerland, Italy, Greece, Palestine, Egypt and Morocco. He expects to complete his work by July 1 and will then go to England to address a meeting of the Royal Society of Tropical Medicine at Oxford University.

During this spring there has occurred throughout the southwest an unprecedented outbreak of the stick-tight flea, *Echidnophaga gallinacea*. The loss has been especially severe among young chicks resulting in a scarcity of friers on many markets. Egg production has also been seriously cut, the reduction ranging from 5 to over 50 per cent. The Bureau of Entomology has been making some inquiries regarding the areas most heavily infested and compiling figures on the losses. The total loss this spring is estimated by the Bureau at over $1,000,000.00.

During March, Doctor R. C. Roark of the Bureau of Chemistry went to Dallas, Texas, laboratory of the Bureau of Entomology, for the purpose of continuing the co-operative work between those two bureaus on the screw worm. Early in May, Mr. E. W. Laake, Mr. H. M. Brundett, Mr. W. E. Dove, all of the Dallas Station of the Bureau of Entomology, and Doctor R. C. Roark began active field work on the screw worm, with Mr. Parman, also of the Bureau of Entomology, in the vicinity of Uvalde. It is planned to carry out extensive field tests with various larvicides and fly repellents during the spring and early summer months.

According to *Science*, Dr. Alexander Kotlan, assistant professor and lecturer on zoology and parasitology at the Veterinary College of Buda Pest, is now in this country as exchange professor under the auspices of the American-Hungarian Foundation. He is carrying on investigations in certain poultry diseases in the department of bacteriology in co-operation with the veterinary department of the Michigan Agricultural College. He lectured at the University of Illinois under the auspices of the department of zoology, April 22, on "A survey of our knowledge on the development of parasitic nematodes with particular reference to the migratory phenomenon" and on April 23 on "The pathologic significance of recent discoveries in the field of the development of parasitic roundworms."

Horticultural Inspection Notes

Mr. A. A. Stalmach, an inspector of the Federal Horticultural Board, was recently transferred from Laredo to Brownsville, Texas.

Mr. G. H. Russell, formerly stationed at Del Rio, Texas as an inspector of the Federal Horticultural Board, has been transferred to Eagle Pass, Texas.

Mr. Stuart D. Whitlock, a graduate of Syracuse University, was appointed Junior Plant Quarantine Inspector at the port of Boston, March 16, 1925.

Mr. F. E. Swan, a graduate of the Mississippi Agricultural and Mechanical College, has been appointed to the position of Junior Entomologist with the Federal Horticultural Board, and is stationed at Laredo, Texas.

Mr. Clinton H. Roth has been appointed to the position of Junior Plant Quarantine Inspector with the Federal Horticultural Board, with headquarters at Eagle Pass, Texas. Mr. Roth is a graduate of the Texas Agricultural and Mechanical College.

Mr. Alan G. Harley, a graduate of the University of Delaware, received his appointment as Junior Plant Quarantine Inspector with the Federal Horticultural Board, on March 2, 1925, his headquarters being designated as New York City.

The annual inspections of nurseries in Tennessee will begin June 15. Already there are over a thousand applications for inspection. The inspectors are: H. L. Fackler, L. E. Barnes, D. E. Drinnon, J. B. Bailey, W. H. Bell and J. C. Moser.

Mr. E. G. Caldwell, Bureau of Entomology, has been appointed an inspector of the Alabama State Board of Horticulture to keep in touch with the sweet-potato weevil situation in the neighborhood of Foley, Baldwin County, where several infested sweet potatoes were recently found in a storage house. He will work in co-operation with S. C. Brummitt, of the Bureau, stationed at Grand Bay, Ala.

The danger of introducing pests to this country in fruit and vegetables carried as ships stores, is well illustrated by two interceptions made recently. An inspector of the Federal Horticultural Board at Galveston collected an insect infesting potatoes from Tampico, Mexico. The insect was identified as *Epicaerus cognatus*, a weevil which is not known to be present in the United States, but which might become a serious potato pest if established here. Inspectors of the Florida State Plant Board collaborating with the Federal Horticultural Board, in the course of routine inspection work, boarded a Standard Oil tanker at Key West, Fla. In the stores was found a quantity of grapefruits and oranges from Tampico, Mexico. The fruit bore no noticeable external evidence of infestation, but upon dissection the grapefruit was found to contain a large number of larvae which proved to be *Anastrepha ludens* Loew., the Mexican Fruit Fly.

On March 18, several regulations under the Canadian Destructive Insect and Pest Act were revised by Order-in-Council. The chief changes affect the apple sucker quarantine in Nova Scotia and the European corn borer quarantine in Ontario. Owing to the fact that the apple sucker was found in the Counties of Westmorland and Albert, in New Brunswick, and that it has spread to the majority of the apple-growing sections of Nova Scotia it was decided to place the whole Province under quarantine to facilitate the shipment of nursery stock. Nursery stock may now be moved within the area comprising the Province of Nova Scotia and the Counties of Westmorland and Albert, in New Brunswick, without restriction, but a certificate of inspection

must accompany all nursery stock moved from the area to any point outside; also the movement of apple, pear, quince or European mountain ash stock from the quarantined area to points outside is prohibited. The chief changes in the corn borer quarantine comprise the addition of Prince Edward County to the general quarantined area and the extension of the double quarantined area to include the counties of Essex, Kent and Lambton.

The staff of the Division of Foreign Pests Suppression at Ottawa has been extremely busy during February owing to an unusually large number of applications for permits for the importation of nursery stock. A total of 1590 permits were issued, 1012 for importations from the United States and 578 for shipments from other countries. These permits are chiefly for spring importations and it is expected that the inspection staff will be taxed to the utmost to handle the work. The privilege of importing through the mails from countries other than the United States, which was arranged with the Post Office Department about a year ago, is becoming very popular and the inspection staff at Montreal is called upon to make several mail inspections daily. It is of interest to note that the regulation affecting the entry of fodder, broom corn, etc., from certain of the United States of America, on account of the foot and mouth disease, was rescinded on February 18. The regulation as it affects other countries remains unchanged. Nursery stock valued at over ten thousand dollars, and miscellaneous stock including such products as fruit and vegetables, valued at nearly twenty thousand dollars, were examined at the various ports of entry during March.

Apicultural Notes

Ontario has pending a bill to license all beekeepers of the Province.

New Zealand lays claim to the largest consumption of honey per capita.

The annual meeting of the West Virginia Beekeepers' Association was scheduled for April 2–3 at the County Courthouse, Charleston.

The first general gathering of beekeepers in Holland was held recently. It is planned to make this an annual occurrence.

Doctor Arnhardt of Austria has found wide variations in the chemical composition of honeydew from conifers. This is especially true as regards manganese and calcium.

Mr. Morley Pettit of Georgetown, Ontario, has decided to locate in Georgia for the purpose of establishing apiaries to supply package bees for his northern apiaries.

Mr. E. L. Sechrist, of the Bee Culture Laboratory of the Bureau of Entomology, gave a talk on beekeeping before the Optimist Club of Washington, D. C., on May 5.

The Ohio State Beekeepers' Association has succeeded in having the legislature increase the appropriation for bee inspection in Ohio from $5000.00 to $10,000.00 annually.

In Switzerland there has been reported a decline in commercial queen-breeders due to the activity of the beekeeping associations in promoting more interest among beekeepers in breeding their own queens.

A scale has been devised in Germany for use with scale colonies. The interesting feature is that the beam is below the platform; consequently no part of the scale need project beyond the bottom-board.

The fourth edition of the book "Les trésors d'une goutte de miel" by Mr. A. Caillas has recently appeared. During the past few years Mr. Caillas has published much of interest on the chemical composition of honey.

The thirty-fourth annual meeting of the Connecticut Beekeepers Association was held at Hartford, April 18. The speakers were Allen Latham, Prof. L. B. Crandall and A. W. Yates. A. W. Yates, Hartford, was elected President and Chas. J. Rost, Meriden, Secretary.

Mr. Sepp Schmid, the Editor of *Bienen Vater*, who recently published a list of the different hives that have been on the market in Europe at various times, has since then published enough additional names to bring the total up to 212.

A bill providing for the inspection of apiaries in New Hampshire has been passed by the legislature and signed by the governor. The bill puts the responsibility for the administration of the law in the hands of the Commissioner of Agriculture.

Prof. J. H. Merrill has resigned as a member of the faculty of the Kansas State Agricultural College, where he was engaged in teaching beekeeping and conducting research work in beekeeping. Prof. Merrill will engage in commercial beekeeping and fruit growing at Raynham, Mass.

Under proposed pure food regulations in Austria, nothing is to be offered for sale as food which bears as part of its name the word "honey" unless it is actual honey produced by the honeybee. Thus the name "artificial honey" would be banned.

There will be a joint summer field meeting of the Colorado Honey Producers' Association and the Colorado State Beekeepers' Association at Loveland, Colorado, on Saturday, June 6. An interesting program is in preparation, with discussions and demonstrations on live topics, and a basket picnic.

Doctor Borchert, of Berlin, has found that the larder beetle, *Dermestes lardarius*, readily eats the scales formed as a result of American foul brood. In the digestive tracts of both this beetle and mites found upon old combs, spores of *Bacillus larvae* were discovered.

Through the co-operation of Mr. H. L. Kelly, a beekeeper of Washington, D. C., in permitting the use of his colonies, Dr. A. P. Sturtevant, of the Bee Culture Laboratory of the Bureau of Entomology, has undertaken some experimental control measures against American foul brood under conditions found in commercial apiaries.

In Germany there is a movement on foot to standardize hive equipment. This is seen in the fact that in the future the Zander, the Lüfteneeger, and the Zaiss hive-bodies are all to have the same dimensions. The new size is almost the same as that adopted by Langstroth.

Mr. E. Sevalle, for more than 35 years secretary general of the Société Centrale d'Apiculture, has been elected president of the society. This breaks the tradition followed a good many years that the president of the association should be a member of one of the two chambers of the French Parliament.

Mr. M. R. Blood, one of the special students in the Department of Entomology, University of Tennessee, has accepted a position with the C. P. Dadant Company, Hamilton, Illinois. Mr. Dana E. Drinnon, graduate of the University of Tennessee, has accepted a position with the Tennessee State Board of Entomology as Assistant Entomologist.

Mr. George H. Rea, at one time in the employ of the Bureau of Entomology as specialist in beekeeping, has recently been appointed to fill the vacancy caused by the resignation of Mr. Norman E. Phillips as Extension Apiarist of Pennsylvania State College. Mr. Phillips resigned for the purpose of engaging in commercial beekeeping.

Czechoslovakia is one of the latest countries to impose restrictions on the importation of bees, honey and wax. This action was inspired no doubt by the recent finding of the mite in the neighboring states of Austria and Germany. *Acarapis woodi* was reported in Czechoslovakia in 1923, but since then no further discoveries have been reported.

Prof. Karl v. Frisch, so well-known through his investigations on the behavior of the honeybee, has left the University of Breslau for the University of Munich. It is interesting to note that in recent public lectures Prof. v. Frisch has shown motion pictures of the "dance of the bees," a term rendered so popular by him.

In a recent issue of the Journal of Agricultural Research there appeared an article, "Morphology of the Honeybee Larva," written by Dr. James Nelson, formerly of the Bureau of Entomology. Another recent work is "Foul Brood Control and Diseases of Bees" by F. L. Thomas and C. S. Rude, published as Circular 36 of the Texas Agricultural Experiment Station.

In certain quarters of Europe it is being advocated that attention be paid to the raising of clover with corolla tubes short enough to enable the honeybee to get nectar readily. As part of the plan the beekeepers would co-operate by an endeavor to rear bees with longer tongues. Several years ago Mr. E. R. Root advocated the same program in this country.

According to *Gleanings in Bee Culture*, arrangements are now being made for the Wisconsin Beekeepers' tour which will be held August 10–14. Five days will be spent in visiting the leading apiaries of half a dozen counties, and the trip will include a demonstration of the community disinfecting outfit for the Hutzelman solution. The apiary inspectors of the State Department of Agriculture are planning the program.

Prof. Yoshinobu Tokudo, of the Imperial Zootechnical Experiment Station, Chiba, Japan, is the author of a most interesting article on the Japanese honeybee. This appeared in a recent edition of the Transactions of the Sapporo Natural History Society. The author has set forth evidence from which he concludes that the Japanese honeybee is a variety of *Apis indica* and not of *Apis mellifica*, thus following Dr. v. Buttel-Reepen.

The Biological Institute of Dahlem near Berlin has announced a six-day course on bee diseases to be repeated four times during the summer. Doctor Borchert will be in charge. The course will be given primarily for practical beekeepers, but it is interesting to note that each person in attendance is to provide himself with a microscope equipped with an oil-immersion lens. The Leitz Company will furnish these at the nominal rental of three marks for the six days.

Dr. Ferdinand Gerstung, long one of the leading apicultural writers of Germany, died on March 5, 1925, the day before the 65th anniversary of his birth. Among other things Doctor Gerstung established the journal, Die Deutsche Bienenzucht in Theorie und Praxis, and continued as its editor for 32 years until he was forced to give up the work at the beginning of this year because of ill health. Furthermore, as

stated recently in these columns, Doctor Gerstung was one of two men to have been granted an honorary doctor's degree in recognition of services to apiculture.

Acarapis woodi was reported in Germany for the first time in February of this year. Infected colonies were found in Bavaria, not far from where the mite was first reported in Austria. Since this discovery, Doctor Armbruster, the Editor of the Archiv für Bienenkunde, has found the mite in Pomerania. In view of the wide-spread occurrence of the mite in Europe, it is quite remarkable that the mite has apparently never been discovered in the United States. The Bee Culture Laboratory will continue its search for the parasite this summer, however, and has asked beekeepers to send in for diagnosis samples of adult bees which have died because of any seemingly abnormal condition.

Among recent visitors at the Bee Culture Laboratory of the Bureau of Entomology were Dr. A. D. Imms, of the Rothampstead Experimental Station, England; Dr. E. F. Phillips of Cornell University; Mr. Archie D. Shaftesbury, Instructor in Zoology at the North Carolina College for Women; Mr. A. C. Tate of the Emery Scale Company of Connecticut; and Mr. Virgil Argo of Cornell University. The visit of Mr. Tate was for the purpose of making adjustments on the self-recording scale which his company recently manufactured for the Laboratory, while that of Mr. Argo was in connection with his investigations of *Braula coeca* in Carroll County, Maryland, which he is carrying on in connection with graduate work at Cornell University.

Tennessee has 17 commercial queen breeders; 191,898 colonies of bees located on 30,961 farms. Besides these there are some 200,000 colonies of bees located in suburbs of the larger towns and cities. Tennessee ranks second in the number of colonies kept on farms and seventh in the number of pounds of honey produced annually. Since 1911, one thousand dollars a year has been appropriated for bee inspection service; the last legislature appropriated an additional thousand dollars a year for this service. The present inspector, Mr. W. L. Walling, working under the direction of the State Entomologist is rendering valuable services. Very little American foul brood exists in the State; it is expected that the inspections now in progress will prove a negative showing.

A foul brood law has been passed by the Wyoming State legislature, carrying an appropriation of $10,000.00 for apiary inspection and investigation. This new law is the first to recognize the treatment of combs for the purpose of sterilizing them in the control of the brood diseases of bees, since it mentions "combs" among the equipment that shall be disinfected in colonies in which American foul brood is found. The law also provides that every apiary must be listed with the office of the state entomologist; that apiaries shall not be moved without first having secured a certificate of health or permission from an authorized bee inspector; that bees on combs cannot lawfully be shipped into the state, as well as a number of other provisions to prevent the dissemination of the brood diseases.

Mr. Jas. I. Hambleton, of the Bee Culture Laboratory of the Bureau of Entomology, spoke before the Garden Club of Rockville, Maryland, on April 25. On April 29 he attended a meeting of beekeepers and horticulturists in Providence, Rhode Island. On May 9, Mr. Hambleton left for the temporary field station on the coast of Delaware, where he will endeavor to determine the effect of various weather factors upon the flight activities of the honeybee. In the region chosen for carrying on this work there are no nectar bearing plants. This permits the substitution of an artificial

honey flow through the use of feeders. By maintaining a constant, uniform supply in the feeders, variations in flight activities will be due to causes other than availability of the substitute for nectar. The following temporary helpers will be employed in connection with this work: Miss Elsie Smith, Washington, D. C.; Miss Dorothy Black, Washington, D. C.; Mrs. Dorothy P. Cooper, Ocean View, Delaware; and Mr. W. Alderson Lynch, Ocean View, Delaware.

AN IMPROVED DISINFECTANT FOR AMERICAN FOULBROOD

In November, 1923, Geo. S. Demuth reported the success of Dr. J. C. Hutzelman in sterilizing frames infected with American foulbrood by means of a solution of formaldehyde and alcohol (Gleanings in Bee Culture **51**: 712–717). This process, although extremely effective, is expensive on account of the initial cost of the alcohol and the loss of this component by evaporation.

The writer determined nearly two years ago that the effective disinfecting agent of the combination was the formaldehyde, the alcohol only facilitating penetration and the loosening of the scales left in the cells of the dead brood. Further trials reported by the writer in Feb. 1925 (American Bee Journal **65**: 55) showed that a solution of liquid soap would accomplish the same results previously obtained by the alcohol, thereby materially lessening the initial cost and largely eliminating the factor of evaporation.

The solution is prepared in the apiary by mixing two ounces of liquid soap with one gallon of water and adding one quart of commercial formaldehyde (40%). Repeated cultural trials have shown that combs treated with this solution are sterile, that the scales shake out very readily and that there is no harmful residue of soap left in the treated frames. Field trials with infected combs treated with the soap-formaldehyde-water solution have been equally as satisfactory as those in which the more expensive Hutzelman formula was used.

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